REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release or
Threatened Release of Hazardous Substances in Region 5

FINAL FEASIBILITY STUDY (REVISION 1)
Residential and Commercial Near-Surface Soils (Redacted Version)
Ten-Mile Drain Superfund Site
Saint Clair Shores, Michigan
WA No. 165-RICO-B5BP/Contract No. EP-S5-06-01

August 2017

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

ch2m.

Ecology and Environment, Inc.
Environmental Design International, Inc.
Teska Associates, Inc.

FOR OFFICIAL USE ONLY

Contents

Appendix

Tables

Figures

Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirements
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CH2M	CH2M HILL, Inc.
COC	contaminant of concern
CSM	conceptual site model
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GRA	general response action
HHRA	human health risk assessment
HI	hazard index
IC	institutional control
MBTA	Migratory Bird Treaty Act
MCL	Michigan Compiled Laws
MCPWO	Macomb County Public Works Office
MDEQ	Michigan Department of Environmental Quality
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRCS	Natural Resources Conservation Service
NREPA	Natural Resource and Environmental Protection Act (Michigan)
O&M	operations and maintenance
PCB	polychlorinated biphenyl
ppm	parts per million
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
RSL	regional screening level
SAI	source area investigation
SLERA	screening level ecological risk assessment
TBC	to-be-considered
TCRA	time critical removal action
TMD	Ten-Mile Drain
TSCA	Toxic Substances Control Act
USFWS	U.S. Fish and Wildlife Service

SECTION 1

Introduction

This feasibility study (FS) report for the Ten-Mile Drain (TMD) Superfund Site was prepared in accordance with the Statement of Work for Work Assignment No. 165-RICO-B5BP, Contract No. EP-S5-06-01, for the U.S. Environmental Protection Agency (EPA) as part of the remedial investigation (RI)/FS. This FS has been prepared to address polychlorinated biphenyl (PCB)-impacted near-surface soils located within the TMD site in St. Clair Shores, Michigan.

EPA and the Michigan Department of Environmental Quality (MDEQ) became involved with the TMD site in 2001 after high concentrations of PCBs were identified in sediment samples collected from the Lange and Revere Street canals. Several time-critical removal actions (TCRAs) and interim response actions were conducted by EPA and MDEQ from 2002 through 2010. In October 2010, EPA's Remedial Branch became the lead agency and began characterizing the nature and extent of PCB contamination associated with the TMD site.

Based on the results of an RI conducted from 2013 through 2015, it was determined that the PCB concentration in near-surface soils located outside the TMD utility corridor should be evaluated under a separate FS from the sitewide FS, which addresses the TMD storm sewer system, associated backfill material, and the sediment in the Lange and Revere Street canals. In May 2016, after review and interaction with stakeholders, including MDEQ, the City of St. Clair Shores, and Macomb County, EPA separated the near-surface soils from the sitewide FS.

The overall goal of this FS is to determine which alternatives should be considered for implementation to mitigate unacceptable exposure to PCB-impacted near-surface soils at the TMD site.

1.1 Site Description

The TMD site is located in a mixed commercial/residential area in St. Clair Shores, Macomb County, Michigan. The TMD site encompasses a several-block area bounded by Bon Brae Street on the north, Harper Avenue on the west, Ten-Mile Road on the south, and Jefferson Avenue on the east, along with the TMD outfall and the Lange and Revere Street canals.

This document assesses potential remedial alternatives for residential properties located on [redacted] (Investigation Area 1) and [redacted] (Investigation Area 2). Figure 1 shows the site location and properties addressed in this FS.

1.2 Site History and Previous Investigations

Several removal actions and associated investigations have taken place since PCBs were first discovered in the TMD storm sewer system in 2001. This section provides the history of the site and a brief discussion of the various removal, remedial, and enforcement activities and associated investigations that have been conducted at the site.

The Macomb County Public Works Office (MCPWO) collected sediment samples as part of a dredge permit application in August 2001, and initially identified the PCB contamination in the Lange and Revere Street canal sediments. In February 2002, MCPWO traced PCB contamination back to the TMD outfall in the Lange canal and into the TMD storm sewer system. In March 2002, EPA initiated a source investigation at the TMD site. Based on PCB analytical results as high as 121,000 milligrams per kilogram (part per million [ppm]) near the intersection of [redacted], EPA conducted a

TCRA at the TMD site from August 2002 to July 2004. During the removal action, high concentrations of PCB-contaminated sediments were removed from the TMD storm sewer system, the Lange Street canal, the connecting channel between the Revere and Lange Street canals, and a segment of the western end of the Revere Street canal.

Between June 2004 and December 2004, MCPWO collected quarterly stormwater samples inside TMD and identified increasing trends in PCB concentrations, ranging from 1.3 milligrams per liter (ppm) in June to 17,000 ppm in December. Subsequent sampling of the backfill soils surrounding TMD indicated that PCBs were present in backfill at levels as high as 41,000 ppm. In February 2005, PCB concentrations as high as 200,000 ppm were again detected within TMD near the intersection of Harper Avenue and Bon Brae Street. MCPWO requested assistance from EPA in re-evaluating the source of the PCB contamination and, in May 2005, EPA and MDEQ advanced 64 additional soil borings in the TMD study area to better characterize the extent of PCB contamination. PCBs were detected in the backfill surrounding the TMD, with the highest concentrations located near the intersection of Harper Avenue and Bon Brae Street.

As a result, EPA conducted another TCRA in the spring and summer of 2006. As part of the removal action, the inside of the targeted portion of the drain was dewatered to remove sediment, a cured-in-place pipe was installed within a portion of the drain along Bon Brae Street and Harper Avenue to reduce PCB infiltration into the drain from the surrounding backfill materials, monitoring wells were installed, and a large sediment trap was installed at the outfall from the drain. Shallow surface soils in areas that exceeded MDEQ's 4-ppm PCB soil criterion were excavated and disposed and sea walls that may have been impacted by the earlier removal action were repaired. Near-surface soils were also removed from eight residential properties between [redacted] as well as on the commercial property located at [redacted]. Historical property use at this commercial property included an automotive, tool and die shop, and machine shop.

In fall 2007, the City of St. Clair Shores hired Environmental Consulting & Technology (under a grant provided by MDEQ) to perform environmental sampling to monitor the conditions in and around TMD, install monitoring wells along TMD, remove contaminated sediment from portions of TMD, and install two weirs within TMD to slow the migration of PCBs to the Lange and Revere Street canals.

In December 2009, oil containing more than 80 percent PCBs (more than 800,000 ppm) was discovered inside the cured-in-place pipe-lined portion of the sewer located at the Bon Brae Street and Harper Avenue intersection. EPA initiated a TCRA on March 8, 2010, which included the following activities:

- Dewater and clean the sewer along Bon Brae Street, Harper Avenue, and Jefferson Avenue to remove PCB oil, stabilize sediment, and transport and dispose of the PCB-contaminated materials.
- Place oil collection snares within the sewer system manhole vaults near and downgradient of the intersection of Harper and Bon Brae, to prevent migration of oil to the canals.
- Install temporary weir structures in 15 additional manholes throughout the TMD sewer to inhibit future migration of PCB-impacted sediments or oil in the TMD system.
- Perform a geophysical survey, and install soil borings near contaminated areas and suspected source areas near TMD.

EPA also installed 43 additional soil borings at several properties located near the Bon Brae Street/ Harper Avenue intersection based on public tip information regarding potential historical sources of contamination.

EPA proposed the site for the National Priorities List in March 2010 and finalized the site on the National Priorities List in September 2010. In September 2011, EPA selected an interim remedial action to address the high concentrations of PCB oil and contaminated sediments that continued to accumulate

behind the 17 weirs and in the sediment trap at the outfall. The interim action selected in September 2011 consists of ongoing monthly source control activities to handle the accumulation of PCB contamination behind the weirs and at the outfall of the TMD site, in an effort to prevent additional PCB contamination from reaching the canals.

Sediment/oil collected from March 2010 through February 2011 behind the 17 weirs in the TMD storm sewer system indicated that high levels of PCB contamination continued to infiltrate into the drain and accumulate behind the weirs from an unknown source. Based on the sampling results, EPA conducted another removal action at the site on February 26, 2011, to remove PCB oil from the drain. Absorbent snares were used to swipe and adsorb the oil that had collected behind the weirs. Six of the 17 weir locations required cleanout. In April 2011, the City of St. Clair Shores, as a part of its environmental monitoring activities, inspected and removed stained snares and placed clean snares behind the weirs where needed.

In 2011, CH2M HILL, Inc. (CH2M), on behalf of EPA, conducted an additional source area investigation (SAI) to identify the location of the ongoing source that continued to re-contaminate the TMD storm sewer system. The primary focus of the SAI was the utility corridors transecting the TMD utility corridor and the TMD utility corridor itself. The SAI identified the highest concentrations of PCBs adjacent to four vaulted manholes along Bon Brae Street, and concluded that sufficient PCB contamination was present in the fill surrounding these vaults to be the source (secondary) of the ongoing contamination in the TMD storm sewer system (CH2M 2011). In August 2011, after completion of the SAI, the EPA FIELDS team conducted sampling to characterize the nature and extent of PCBs within the sediments of the Lange and Revere Street canals (EPA 2012).

On April 16, 2014, EPA signed an Action Memorandum to conduct a time-critical removal action at 10 properties, including 8 public rights-of-way, 1 residential yard, and part of a commercial property to prevent human exposure to elevated levels of PCBs in near-surface soil. The removal action began on May 27, 2014, and was completed on July 10, 2014. Approximately 1,504 tons of contaminated soil was disposed of offsite. A total of 1,087 tons was disposed of at a landfill licensed under the Toxic Substances Control Act (TSCA), and 417 tons were disposed of at a RCRA Subtitle D landfill. The activities completed as part of this removal action included the following:

- Site perimeter air samples were collected during active excavation activities.
- Impacted properties were excavated to various depths ranging from 6 to 40 inches.
- Excavations were backfilled with clean fill or topsoil.
- Yards were regraded to original or improved grades.
- Yards were sodded and excavated trees were replaced.

EPA issued a second interim Record of Decision (ROD) for the TMD site on May 16, 2014. The second interim remedial action selected in the ROD addressed the PCB contamination in the bedding and backfill materials at the base of vaulted manholes M7179 and J01 in the TMD storm sewer system. In 2015, during the excavation of the M7179 manhole vault, PCB-containing oil was observed flowing from between the cured-in-place pipe liner and the 48-inch-diameter concrete pipe that extends under Harper Avenue. Based on the oil present beneath the cured-in-place pipe liner in the drain beneath Harper Avenue and to prevent recontamination of areas that had already been remediated as part of the interim action, EPA expanded the interim action to include the removal and replacement of 120 feet of 48-inch-diameter reinforced concrete pipe along with the bedding materials between manhole vaults M7179 and J01. The excavation of the reinforced concrete pipe led to several other modifications to the remedy components described in the 2014 interim ROD. The 2016 Explanation of Significant Differences summarized modifications to the original interim action.

CH2M, on behalf of EPA, performed an RI for the entire TMD site between May 2013 and August 2015. Based on the results of an RI conducted from 2013 through 2015, it was determined that the PCB

concentration in near-surface soils located outside the TMD utility corridor should be evaluated under a separate FS from the sitewide FS, which addresses the TMD pipe, associated backfill material, and the sediment in the Lange and Revere Street canals.

The objective of the RI was to delineate the nature and extent of PCB contamination associated with the TMD storm sewer system, including backfill material around the TMD storm sewer, sediment in the Lange and Revere Street canals, the former Martin Drain, and [redacted] Human health and ecological risk assessments were also prepared as part of the RI. The data collected during the RI, and the associated risk assessments, were used as the basis of this FS.

Data collected during the RI, as well as historical data was used to assess the extent of near-surface soil contamination. The following documents contain information on the collection of near-surface soil data:

- Federal On-Scene Coordinator's Report – TCRA 2002-2004 (EPA 2004)
- April-May 2005 Site Investigation Report (Weston Solutions, Inc. [Weston] 2005)
- St. Clair Shores PCB Site – TCRA 2006 (Weston 2007)
- Bon Brae/Harper Site Removal Action – TCRA 2009 (Weston 2010)
- 2011 Source Area Investigation (CH2M 2011)
- Removal Letter Report for St. Clair Shores PCB Drain Removal #2 – TCRA 2014 (Tetra Tech 2014)

1.3 Objectives and Scope

According to EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (EPA 1988) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; EPA 1994), an FS consists of developing remedial alternatives, screening the alternatives if needed to reduce the number, and analyzing selected alternatives in detail. The objective of this FS is to develop and evaluate remedial alternatives that will address unacceptable risks to human health and the environment and meet applicable or relevant and appropriate requirements (ARARs).

As specified in the NCP, the potential alternatives encompass a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but vary in the degree to which long-term management of residuals or untreated waste is required. As required, a no-action alternative is also evaluated. The FS process includes the following steps:

- **ARARs**—Remedial actions performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; as amended in 1986 by the Superfund Amendments and Reauthorization Act) must meet ARARs for selected remedies unless a specific ARAR waiver is requested. ARARs are federal, state, and local public health and environmental requirements used to define the extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with federal ARARs and with state and local ARARs that are more stringent than their federal counterparts, as long as they are legally enforceable and consistently enforced. ARARs are evaluated early in the work-planning process so fieldwork can be designed to collect data necessary to satisfy ARAR requirements and, if necessary, to identify and evaluate remedial alternatives relative to ARARs.
- **Remedial Action Objectives (RAOs)**—Based on existing information, site-specific RAOs that are protective of human health and the environment, as applicable, are identified. The RAOs specify the contaminants and media of concern, exposure routes and receptors, and an acceptable contaminant level or range of levels for each exposure route.
- **Preliminary Remediation Goals (PRGs)**—PRGs are risk-based or ARAR-based chemical-specific concentrations that help further define the RAOs. The PRGs are used to define the extent of contaminated media requiring remedial action.

- **General Response Actions (GRAs)**—GRAs are developed for each medium of interest by defining containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy the RAOs. The GRAs take into account requirements for protectiveness as identified in the RAOs and the site's chemical and physical characteristics.
- **Applicable Remedial Technologies Identification and Screening**—Applicable remedial technologies are identified and screened against the developed GRAs. Treatment technologies are identified and screened so that technologies are applicable to the contaminants present, their physical matrix, and other site characteristics. Screening is based primarily on a technology's ability to address site contaminants effectively, but will also consider its implementability and cost.
- **Remedial Alternatives Development**—Representative remedial technologies and resulting process options are carried forward into the alternative development stage. The effort includes combining representative technologies and GRAs into alternatives, assessing the appropriateness of suggested alternatives, and developing alternatives in sufficient detail for identification of action-specific ARARs.
- **Remedial Alternatives Screening for Effectiveness, Implementability, and Cost**—Potential remedial alternatives are screened to reduce them to a manageable number for later detailed evaluation. Alternatives are screened with respect to their effectiveness, implementability, and cost.
- **Detailed Analysis of Remedial Alternatives**—The detailed analysis of alternatives presents the relevant information needed to compare the remedial alternatives. The extent to which alternatives are evaluated during the detailed analysis is influenced by the data available and the number and types of alternatives being analyzed. Detailed analysis of alternatives consists of a detailed evaluation of each alternative against the evaluation criteria set forth in the NCP.
- **Comparative Analysis of Remedial Alternatives**—Once alternatives are individually assessed against the evaluation criteria, a comparative analysis is conducted to evaluate the performance of each alternative in relation to each evaluation criterion. This approach contrasts with the preceding analysis, in which each alternative is analyzed independently without consideration of other alternatives. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another, so that the key tradeoffs can be identified and balanced by decision makers.
- **Recommended Alternative**—Following the detailed analysis and comparative analysis, an alternative is recommended and will be presented in the proposed plan.

SECTION 2

Conceptual Site Model

The overall conceptual site model (CSM) for the TMD site suggests that the PCB oil contamination originated from a historical release of PCB oil at the commercial property located on the [redacted]. The location of the [redacted] is depicted in Figure 1. Historical property use at this location included an automotive, tool and die, and machine shop. Based on multiple investigations conducted between 2002 and 2011 and the RI conducted between 2013 and 2015, the CSM was developed, and it appears that PCB-contaminated oil was dumped or used for dust control on a former dirt parking lot on the eastern side of the building. The PCB contamination from the parking lot migrated or was transported by the following mechanisms:

- PCB contamination was likely tracked out of the parking lot and onto adjacent properties [redacted] depicted in Figure 2.
- PCB contamination likely entered the TMD storm sewer system during storm events and subsequently discharged into the Lange and Revere Street canals, by adhering to the canal sediments, depicted in Figure 3.
- [redacted] Figure 4 depicts how PCB contamination that had migrated to the canals was likely subsequently deposited in the yards of the [redacted].
- Historical Macomb County drain maps indicate that the former Martin Drain (an open drain) had flowed through the investigation area and discharged at the Rio Vista Canal (northeast of the project site). Based on historical information, it appears that the former Martin Drain was backfilled after the TMD storm sewer was constructed in the mid-1960s. Investigations targeting the former Martin Drain identified PCBs in the area where the former Martin Drain crossed the parking lot of the commercial property located at [redacted], and Figure 5 depicts where PCB contamination likely entered into the former Martin Drain and subsequently migrated along the open drain, depositing trace amounts of PCB contamination.

The PCB contamination associated with the TMD storm sewer and impacted media, including backfill materials, and the canal sediments are being addressed as part of a separate sitewide FS. The following subsections summarize the physical and contamination characteristics of the impacted residential and commercial near-surface soils as identified in the RI and provide further detail on the elements of the CSM.

2.1 Site Soils

The TMD site is located in an area classified as containing approximately 85 percent (by area) Lenawee clay, 10 percent Toledo silty clay loam, and 5 percent Del Ray loam soils (Natural Resources Conservation Service [NRCS] 2013). These soils are typical of clayey glaciolacustrine deposits that formed on flats of till-floored lake planes (NRCS 2013). Soil samples collected during the RI from surface to 5 feet below ground surface (bgs) were typically characterized as topsoil (0 to 6 inches bgs) and dense clay underlying the topsoil to 5 feet bgs consistent with the NRCS classifications. The native soils of the site are characterized as having very low transmissivity rates. No water-bearing seams have been identified at the site from 0 to 20 feet bgs.

2.2 Site Surface Water Hydrology

Based on the SAI and RI results, no groundwater aquifer is present within 20 feet of the ground surface at the site. The site is located within the Lake St. Clair watershed (EPA 2014). Historical Macomb County drain maps indicate that the former Martin Drain (an open aboveground drain) had formerly flowed through the investigation area and discharged at the Rio Vista Canal (northeast of the project site; Macomb County Drain Commission 1962). The approximate location of the former Martin Drain is as it relates to the commercial property on the corner of [redacted] is depicted in Figure 1. Based on historical information, it appears that the Martin Drain was backfilled after the TMD was constructed in the mid-1960s.

There is minimal topographical relief at the site. Residential and commercial properties are contoured to direct stormwater runoff towards the street or parking lots where the stormwater enters catch basins that connect to the TMD storm sewer system. Water entering the TMD storm sewer system discharges into the Lange and Revere Street canals and subsequently into Lake St. Clair.

2.3 Nature and Extent of Near-surface soil Contamination

This subsection summarizes the nature and extent of near-surface soil contamination identified in residential and commercial properties and parkways identified in the RI report (CH2M 2016a). PCBs are the only contaminant of concern (COC) associated with the TMD site. The first step in the nature and extent evaluation was to select conservative screening levels for total PCBs at the site. Screening tools were used to identify chemicals that might pose a risk to human health. For nature and extent purposes, the MDEQ human health risk-based direct contact criteria of 4 ppm for residential properties and 16 ppm for commercial properties were used as the screening levels during the RI. The MDEQ Part 201 cleanup criteria are currently being revised, and it is likely the new residential and commercial direct-contact criteria will be revised to 1.9 ppm and 20 ppm, respectively. Therefore, a more conservative screening criteria of 1 ppm for residential properties and 10 ppm for commercial properties and utility corridor soil was used for screening purposes. Because of the change in the screening levels used to assess properties requiring cleanup in accordance with this FS, additional properties will require sampling as part of predesign studies. As stated earlier, no groundwater is present within 20 feet of ground surface, and PCB concentrations have been delineated vertically; therefore, human exposure to impacted groundwater is incomplete and not considered further in this document.

During the RI, geostatistical sampling was conducted by advancing a minimum of eight borings in each exposure unit. The number of borings advanced on each exposure unit was based on the size of the exposure unit. Larger exposure units had more than eight borings advanced.

The soil borings were advanced to a maximum depth of 3 feet bgs. Soil was collected from each boring at the following intervals:

- 0 to 0.5 foot bgs
- 0.5 to 1 foot bgs
- 1.0 to 1.5 feet bgs
- 1.5 to 2.0 feet bgs
- 2.0 to 2.5 feet bgs
- 2.5 to 3.0 feet bgs

Soil samples within an exposure unit were homogenized into a composite sample for each interval. A portion of the composited samples was analyzed for PCBs by EPA's laboratory. Initially, EPA's laboratory analyzed the 0 to 0.5 foot bgs, 1.0 to 1.5 feet bgs, and 2.5 to 3.0 feet bgs samples. If analytical results were above 2 milligrams per kilogram for an analyzed interval, then the next lowest interval was submitted to the mobile laboratory for analysis. Geostatistical sampling treats a specific exposure unit,

such as a front yard or parkway, as an individual area, and the concentration is based on a representative value for that exposure unit, not an individual sample point.

The PCB concentrations in the near-surface soil along [redacted] The PCB concentrations in the Lange and Revere Street canal sediments generally decrease with distance from the TMD outfall. However, the PCB concentrations [redacted] along the canals are more randomly distributed and are likely a combination of PCB concentrations in the sediment adjacent to [redacted] or other activities.

PCB concentrations also generally decrease with depth at both the residential and commercial properties, and the highest concentrations were typically found within 2.5 feet of ground surface. Forty-two of the 84 exposure units sampled contained PCBs greater than 1 ppm. The highest concentration was located in the 0- to 0.5-foot interval on 35 of the 42 exposure units with PCB concentrations exceeding 1 ppm. The PCBs were vertically delineated to below 1 ppm on 32 of the 42 exposure units. All 32 exposure units were below 1 ppm within 2.5 feet of ground surface. The 10 exposure units that do not have the vertical extent of PCBs delineated currently do not have any geostatistical samples collected beneath the 1.5 to 2 feet bgs interval and additional delineation will be necessary as part of a predesign study.

2.3.1 Exposure Unit

During the RI, 84 residential exposure units were geostatistically sampled. Forty-two of the residential exposure units had PCB concentrations above the screening criteria of 1 ppm. In 2014, EPA conducted a TCRA excavating near-surface soils in areas exceeding Removal Management Levels of 22 ppm for Aroclor 1248 and 3.4 ppm for Aroclor 1254. The removal action addressed 10 residential exposure units and part of the commercial property located at [redacted] PCB-contaminated soil was removed to below 4 ppm on residential exposure units and the commercial property, the State of Michigan residential cleanup criteria at the time of the TCRA, and restored with a clean fill layer. A more conservative screening criteria of 1 ppm for residential properties was used for this FS. After the 2014 TCRA, 32 residential exposure units remain with PCB concentrations exceeding 1 ppm in the near-surface soils.

Table 2-1 summarizes the residential and commercial exposure units (front yards, back yards, and parkways), with the total PCB concentrations exceeding human health-related screening levels of 1 ppm in near-surface soil.

Table 2-1. Exposure Units with PCB Concentrations Exceeding Screening Levels
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Criterion Levels		**TSCA**		
Residential Properties		**(1.0 ppm)**		
[redacted]	**Exposure Units Sampled**	**Exposure Units Exceeding TSCA**	**Highest Concentration (mg/kg)**	**Total Properties***
Parkway	18	7	7.6	
Front Yard	18	6	8.0	11
Back Yard	3	2	3.9	
[redacted]	**Exposure Units**	**Exposure Units Exceeding TSCA**	**Highest Concentration (mg/kg)**	**Total Properties***
Parkway	3	3	1.59	
Front Yard	12	5	2.9	7
Back Yard	3	2	9.4	

Table 2-1. Exposure Units with PCB Concentrations Exceeding Screening Levels
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

[redacted]	Exposure Units	Exposure Units Exceeding TSCA	Highest Concentration (mg/kg)	Total Properties*
Parkway	Not Applicable	Not Applicable		
Front Yard	Not Applicable	Not Applicable	2.9	7
Back Yard	27	7		
Totals	84	32	9.4	25

* A Property may include more than 1 exposure unit.
mg/kg = milligram per kilogram

2.3.2 Discrete Samples

Based on discrete RI samples, 18 additional properties (17 residential and 1 commercial) require predesign sampling. Discrete sample PCB concentrations exceeding 1 ppm on residential properties ranged from 1.1 ppm to 169 ppm. Discrete sample PCB concentrations exceeding 10 ppm on the commercial property ranged from 45 ppm to 530 ppm. The former Martin Drain was located on 7 of the properties that had discrete sample PCB concentrations exceeding 1 ppm requiring predesign sampling. The former Martin Drain sampling is discussed in more detail in the following subsections.

Former Martin Drain

During the RI, 80 samples were collected from the 45 borings installed to target the former Martin Drain corridor. Twenty-five of the 80 samples were collected within 2.5 feet of ground surface. The low-level near-surface contamination related to the former Martin Drain generally decreases with distance from the commercial property located at [redacted]. Three of the 25 near-surface samples had concentrations above 1 ppm. None of the 46 samples collected from the 25 borings installed near [redacted] contained PCB contamination above 1 ppm. As depicted in Figure 1, the contamination related to the former Martin Drain drops below 1 ppm to nondetect after it intersects [redacted]. The former Martin Drain is not a significant migration pathway to Lake St. Clair.

As part of the Martin Drain investigation, discrete samples were collected in the parkway and utility corridors along [redacted] One sample collected in the parkway on [redacted] (169 ppm at 3.4 feet bgs where the old Martin Drain formerly crossed [redacted] exceeded the utility worker screening level of 10 ppm. Other discrete samples collected in the utility corridor/parkway contained PCBs at (19 ppm at 4 to 4.5 bgs – parkway on [redacted] 48 ppm at 3.4 feet bgs – parkway on [redacted]; and 13 ppm at 4 to 4.5 feet bgs – parkway on [redacted]

Roads

Twenty-four borings were advanced through Bon Brae Street during the RI. Two samples collected within 3 feet of the road surface (both located near vaulted manhole J01) had PCB concentrations above 10 ppm.

2.4 Contaminant Fate and Transport

The following paragraphs discuss the contaminant fate and transport processes within the TMD site. The processes make up the CSM, which is presented in Figures 2, 3, 4, and 5. The primary source of PCBs present in the TMD near-surface soils is associated with historical releases (spills/dust control) at the [redacted] property and subsequent track out from the property. The primary transport

mechanism for PCBs from the [redacted] property to residential properties located along [redacted] appears to have been trackout of PCB oil and impacted soil from the unpaved parking lot by vehicles, bicycles, and pedestrians.

The trackout transport mechanism of PCB contamination from the commercial property may have impacted the road base on Lakeland Avenue and Bon Brae Street. However, based on the samples collected beneath Bon Brae Street during the RI, the extent of impacted road base appears to be minimal.

In addition, the former Martin Drain transected a portion of this unpaved parking lot on the commercial property; subsequently, the historical releases migrated along the open drain depositing trace amounts before it was backfilled and replaced by the TMD storm sewer system.

The primary transport mechanism for PCBs from the [redacted] property to the properties located along the Lange and Revere Street canals appears to be stormwater runoff from the [redacted] property to catch basins entering the TMD system. PCB oil mixed with suspended sediments were then deposited into the Lange and Revere Street canals. [redacted], depositing contaminated suspended particulates onto their back yards.

2.4.1 Potential Contaminant Migration

Potential migration routes for PCBs in surface soil were assessed according to the contaminant properties and the fate and transport processes. The following subsections discuss potential migration routes for the TMD site for each environmental medium.

Soil to Air

Physical disturbance of soils and release of dust/particulates from surface soils in residential yards and commercial green space are the primary pathways for PCBs to be released into the atmosphere from the TMD site. PCBs can be released to the atmosphere through mobilization of windborne, contaminated dust. The majority of near-surface soils at the TMD site are either grass-covered or are covered by an impermeable surface such as concrete or asphalt. Therefore, the potential for PCB-impacted dust to become airborne during normal conditions is minimal. Activities that mechanically disturb the near-surface soils can potentially cause PCB-impacted dust to become airborne.

Soil to Surface Water and Groundwater

Due to the dense clayey native soils at the TMD site and the insolubility of PCBs in stormwater, the PCBs in the near-surface soil have limited mobility. Based on soil borings installed during the RI, there is no groundwater within 20 feet of ground surface at the site. PCBs have not leached more than 3 feet into the subsurface at the site; therefore, the soil leaching to groundwater pathway is not complete. Additionally, the residents within the TMD site are served by the City of Detroit public water supply, which obtains drinking water from the Detroit River, and groundwater is not being used at the TMD site as a drinking water source.

Historically, likely when the parking lot was not paved at the commercial property located at [redacted], PCBs were transported by direct runoff and soil erosion to the TMD storm sewer, which discharges to the Lange and Revere Street canals. PCBs that were adsorbed to soil particulates were deposited into the TMD storm sewer system and subsequently into the canals. [redacted] above the screening criteria of 1 ppm. Figure 4 depicts how the PCB-impacted sediment is deposited into the [redacted]. Currently, the majority of the near-surface soils at the TMD site have grass cover or impermeable surfaces such as concrete or asphalt. Therefore, potential migration under current conditions to surface water through runoff is considered minimal.

2.5 Risk Assessment Summary

Potential risks posed by PCBs detected in the TMD near-surface soils were evaluated in a human health risk assessment (HHRA) and screening-level ecological risk assessments (SLERA) as part of the RI (CH2M 2016a, 2016b, and 2016c). The following subsections summarize the results of each assessment.

2.5.1 Human Health Risk Assessment

The HHRA evaluated current and future residents (adults and young children) assumed to be exposed to PCBs in residential yard and parkway surface soil through incidental ingestion, dermal absorption, and inhalation of soil/dust. Geostatistical sampling was used to assess the majority of residential yards and parkways. The geostatistical sample results were evaluated independently as part of the residential area HHRA for the RI. Historical grab samples on 18 additional properties exceeded screening criteria of 1 ppm, including the samples collected within the former Martin Drain corridor.

In general, COCs are identified when the potential excess lifetime cancer risk (ELCR) for a receptor group exceeds the upper end of EPA's target range (a total ELCR of 1×10^{-4}) for ELCRs associated with CERCLA sites, which is 1 in 10,000 (1×10^{-4}) to 1 in 1 million (1×10^{-6}) or EPA's threshold hazard index (HI) of 1. A total ELCR or noncancer HI above the target risk range or HI threshold indicates that the site may warrant further action to reduce risks to acceptable levels. EPA's noncancer regional screening level (RSL) for total PCBs for children and pregnant woman is 1.2 ppm (EPA 2015).

The HHRA concluded the following:

- Residential soil—Currently, 32 known residential exposure units have PCB concentrations exceeding the HI threshold of 1.2 ppm for children and pregnant women, although the estimated HI for the adult resident exposure scenario and estimated ELCR for adult/child aggregate scenario were below the HI threshold and within EPA's acceptable risk range. Therefore, total PCBs were identified as a COC in residential soil.
- Commercial soil—The commercial worker exposure scenario estimates based on MDEQ's total PCB cleanup level for non-residential land use (16 ppm) and TSCA (25 ppm for low occupancy areas) were within EPA's target risk range for uncapped portions of the [redacted] property. However, concentrations under the parking lot are above EPA RSLs and MDEQ screening levels.
- Former Martin Drain—Utility Worker Corridor Soil—The estimated HIs for utility workers exceeded EPA's HI threshold in three of four exposure areas evaluated in the HHRA [redacted] However, the ELCRs were below or within EPA's target range. The utility-worker scenario evaluated for the data collected from utility corridors along Harper Avenue is the only exposure scenario whose estimated HI and ELCR were below EPA's HI threshold and target risk range. The impacted soil in the TMD utility corridor is being addressed in the TMD Sitewide FS.

2.5.2 Ecological Risk Assessment

A SLERA was prepared for the site during the RI (CH2M 2016c). The SLERA was conducted in accordance with EPA guidance for conducting ecological risk assessments. The data generated from the RI activities were used to assess potential risks for both lower trophic-level (direct exposure) and upper trophic-level (food web exposure) risks for a variety of terrestrial receptors using multiple lines of evidence in a weight-of-evidence process, which includes assessing risk estimates in context with the extent, magnitude, and ecological significance of each line of evidence. Based on the weight-of-evidence evaluation, total PCBs were not identified as presenting unacceptable ecological risk in upland terrestrial soils.

SECTION 3

Alternative Development and Screening

This FS was conducted to address potential risk to human health posed by PCB-impacted near-surface soils at the TMD site. The FS consists of the following steps:

- Identify ARARs.
- Develop RAOs.
- Determine PRGs and identify areas exceeding the PRGs.
- Evaluate COCs against remediation goals.
- Develop GRAs.
- Identify and screen technologies.
- Develop remedial alternatives.
- Perform detailed analysis of remedial alternatives.
- Perform comparative analysis of each alternative's ability to satisfy the evaluation criteria.
- Present a recommended alternative (will be presented in the proposed plan).

3.1 Applicable, Relevant, and Appropriate Requirements

Remedial actions must protect public health and the environment and address risks identified in the human health and ecological risk assessments. Section 121 of CERCLA requires that primary consideration is given to remedial alternatives that attain or exceed ARARs. ARARs must be complied with unless one of the waivers in the NCP is invoked. The purpose of this requirement is to make CERCLA response actions consistent with other pertinent federal and state environmental requirements and adequately protect human health and the environment.

ARARs are grouped into three types: chemical-specific, location-specific, and action-specific. Table 3-1 includes the chemical-specific, action-specific, and location-specific ARARs for near-surface soils at the TMD site. The most critical ARARs are discussed in the following subsections. To-be-considered (TBC) factors are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs unless they are included in the ROD. However, in many circumstances, such factors will be considered, along with ARARs, in determining the level of cleanup required to protect human health and the environment. Table 3-1 lists potential ARARs, along with ARAR-specific status analysis relative to remediation for near-surface soils at the TMD site.

3.1.1 Chemical-Specific ARARs

Chemical-specific ARARs include laws and requirements that establish health- or risk-based numerical values or methodologies for environmental contaminant concentrations or discharge. TSCA (40 *Code of Federal Regulations* [CFR] 761.61) is the only chemical-specific federal ARAR for the near-surface soils. Because of the history and nature of PCB disposal, the soils will be regulated in accordance with 40 CFR 761.61(c) risk-based disposal. Michigan Natural Resource and Environmental Protection Act (NREPA) Act 451 Parts 20120a and 20120b, along with associated Michigan Administrative Codes R299.46, R299.48, R299.49, and R299.50, are ARARs for developing site cleanup levels. TBC factors for residual soil concentrations include the EPA RSL Table for Chemical Contaminants at Superfund Sites and the CERCLA Guidance on Land Use in the CERCLA Remedy Selection Process.

Table 3-1. Applicable or Relevant and Appropriate Requirements - Near-surface soils

Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Regulation	Requirement	ARAR Status	Analysis
Chemical-specific ARARs or TBCs			
Federal			
40 CFR 761.61(a)(1)(ii) and 40 CFR 761.61(c) –TSCA Regulations	Establishes requirements and thresholds for remediation and management of PCBs. Provides for risk-based cleanup.	Relevant and Appropriate	Relevant and appropriate for establishing remedial goals for soil that is PCB Remediation waste. Requirements are not binding on CERCLA sites 761.61 (a)(1)(ii)).
CERCLA Guidance on Land Use in the CERCLA Remedy Selection Process	Establishes appropriate considerations in defining future land use.	TBC	CERCLA provides guidance to EPA in selecting land use for remedy selection purposes. These requirements are TBCs.
EPA Regional Screening Level Table for Chemical Contaminants at Superfund Sites	Screening levels developed using risk assessment guidance from the EPA Superfund program. They are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. Screening levels are considered to be protective for humans over a lifetime; however, screening levels do not address non-human health endpoints, such as ecological impacts.	TBC	Levels may be considered for use as initial cleanup goal. These requirements are TBCs.
State			
Part 201, Environmental Remediation, of NREPA, 1994 PA 451, as amended. (MCL 324.201, et seq.) Michigan Administrative Codes R 299.46, R299.48, R299.49, and R299.50	Part 201 provides for the identification, risk assessment, evaluation, remediation, and long-term management of contaminated sites within Michigan. Part 201 provides that response actions shall be protective of human health, safety, welfare and the environment of the state and identifies risk levels to be used in the development of those response actions at MCL 324.20120a.	Relevant and Appropriate	Establishes cleanup criteria for sites of environmental contamination based on current and future land use. Regulates cleanup of releases of hazardous substances in concentrations that constitute a facility as that term is defined in Section 20101(o) of Act 451 to soil and groundwater.

Table 3-1. Applicable or Relevant and Appropriate Requirements - Near-surface soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Regulation	Requirement	ARAR Status	Analysis
Location-specific ARARs or TBCs			
Federal			
Migratory Bird Treaty Act of 1972 16 USC 703-712	Establishes federal responsibility for the protection of the international migratory bird resources. Consultation with the USFWS during remedial design and remedial construction is strongly encouraged to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Taking, killing, or possessing migratory birds is unlawful with authorization from USFWS.	Applicable	Michigan is located within the Mississippi flyway. If migratory birds, their nests, or eggs are discovered, disturbed will be avoided to the extent practicable, and will be coordinated with USFWS.
50 CFR 17 – Threatened and Endangered Species Protection	Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Applicable	Habitats and the presence of threatened and endangered species and their habitats will be evaluated as the alternatives assessment progresses. Measures will be taken to avoid jeopardizing fish, wildlife, or plant species or destroying or adversely modifying critical habitat, to the extent practicable.
15 CFR 930 – Coastal Zone Management	Requires that federal agencies conducting activities directly affecting the coastal zone conduct those activities in a manner that is consistent, to the maximum extent practicable, with approved state coastal zone management programs.	Applicable	Coastal zone management applies to construction activities and aims to achieve a balance between natural resources preservation and economics. Because the project does not include economic development, it is unlikely that substantive requirements will relate to the remedy.
State			
NREPA, Part 365, Endangered Species Protection, and MCL 324.36501-36507), and Michigan Administrative Code R 299.1021-1028	Establishes requirements for conservation, management, enhancement, and protection of species either endangered or threatened with extinction.	Relevant and Appropriate	Relevant and appropriate for actions that are likely to jeopardize fish, wildlife, or plant species or destroy or adversely modify critical habitat. Would not be considered applicable unless federal endangered species law is less stringent.

Table 3-1. Applicable or Relevant and Appropriate Requirements - Near-surface soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Regulation	Requirement	ARAR Status	Analysis
NREPA Part 401, Wildlife Conservation. (MCL 324.40101-40120)	Regulates wildlife conservation.	Relevant and Appropriate	May be applied to identifying wildlife habitat near environmental sites of contamination where an ecological risk assessment(s) may be conducted. May be used in conjunction with the Michigan Features Inventory List to identify habitat where an environmental site of contamination may impact wildlife.
Action-specific ARARs or TBCs			
State			
NREPA Part 115, Solid Waste Management). (MCL 324.1 1501 et seq.) Michigan Administrative Code R 299.41 01-4122 (Formerly known as Act 641 [1978])	Addresses solid waste management and imposes geographic limitations on where nonhazardous solid waste can be disposed.	Relevant and Appropriate	Regulates the disposal of nonhazardous solid waste. Remedial action may produce nonhazardous solid waste. Used for determining the process and type of disposal facility that solid waste or contaminated media may be removed to. It is anticipated that site soils will contain less than 50 ppm PCBs and will be disposed of in a commercial Resource Conservation and Recovery Act Subtitle D facility approved under the CERCLA Offsite Rule.
NREPA, R 323.1709 – Erosion and Sediment Control	Establishes requirements for the control of erosion and sedimentation during earth change operations.	Applicable or Relevant and Appropriate	Relevant and appropriate to the excavation of highly contaminated soil. Applicable if more than 1 acre will be disturbed or for any disturbance within 500 feet of the water's edge of a lake or stream. Requires development of measures to minimize the erosion of soil and discharge of soils and sediment to nearby waters.
NREPA, R 336.1372(8)(b) – Control of Fugitive Dust	Establishes common measures to mitigate the generation of fugitive dust during small construction work.	Relevant and Appropriate	Relevant and appropriate for remedial actions where contaminated soil may become airborne. Measures such as wetting of airborne soil during excavation activities are often effective at controlling dust.

MCL = Michigan Compiled Laws

USFWS = U.S. Fish and Wildlife Service

3.1.2 Location-Specific ARARs

Location-specific ARARs are requirements that relate to the geographical position of the site. Examples of location-specific ARARs include state and federal laws and regulations that apply to the protection of wetlands, construction in floodplains, and protection of endangered species in streams or rivers. The most significant location-specific ARAR for near-surface soils at the TMD site is the Migratory Bird Treaty Act (MBTA). Compliance with the MBTA will be achieved by establishing certain design criteria.

3.1.3 Action-Specific ARARs

Action-specific ARARs regulate the specific type of action, technology under consideration, or the management of regulated materials. Action-specific ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the remedial activities selected to accomplish a remedy. For this remedy, all alternatives, except no action, include excavation, backfill, restoration, and offsite disposal; therefore, the action-specific requirements are the same across all the alternatives. Regulations promulgated in Michigan that address solid waste management and disposal, soil erosion and sediment control, and fugitive dust requirements are the most important action-specific ARARs to be complied with during implementation of remedial action alternatives for the near-surface soils at the TMD site.

3.2 Remedial Action Objectives Summary

RAOs are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs should be as specific as possible but not so that the range of alternatives to be developed is unduly limited. Objectives aimed at protecting human health and the environment should specify the following: (1) COCs, (2) exposure routes and receptors, and (3) an acceptable contaminant level or range of levels for each exposure route (PRG) (EPA 1988).

RAOs were developed for near-surface soils at the TMD site with consideration to the contaminant levels and exposure pathways found to present potentially unacceptable risk to human health and the environment as determined during the RI. Unacceptable potential risk was estimated for children and pregnant women, which formed the basis for development of the following RAOs for soil.

- To prevent direct human contact with or ingestion and inhalation of PCBs in soils at residential and commercial properties by current and potential future residents during typical residential activities such as playing in the yard, gardening, and landscaping that could result in an unacceptable risk to human health.
- To prevent direct human contact with or ingestion and inhalation of PCBs in utility corridor soil and (parkways) by the utility workers during construction activities within the utility corridors.

3.3 Preliminary Remediation Goals

PRGs are risk-based or ARAR-based chemical-specific concentrations that help further define the RAOs. PRGs are considered “preliminary” remediation goals because the final remedial goals are defined in the ROD once a remedy is selected for the site. The PRGs are used to define the extent of contaminated media requiring remedial action.

- The PRG of 1 ppm for residential properties was selected and is in consistent with TSCA, which was identified as the primary chemical specific ARAR. This PRG will mitigate the potential routes of exposure: incidental ingestion, dermal contact, and inhalation associated with the near-surface soil contamination. The PRG of 1 ppm will be protective of human health because it is:

  - Below EPAs residential soil RSL based on a target HI of 1 (1.2 ppm)
  - Within EPAs acceptable risk range of 10^{-4} to 10^{-6} for residential soil (23 ppm to 0.23 ppm)
  - Meets the cleanup level for "high occupancy areas" under TSCA (40 CFR 761.61(a)(4)(i)(A)) and,
  - Below the MDEQ proposed residential risk-based cleanup value of 1.9 ppm.
- The PRG of 10 ppm was selected for commercial properties and is in consistent with TSCA, which was identified as the primary chemical-specific ARAR and is protective of human health based on commercial exposure scenarios. The PRG of 10 ppm will be protective of human health because it is:
  - Below EPAs industrial soil RSL based on a target HI of 1 (15 ppm)
  - Within EPAs acceptable risk range of 10^{-4} to 10^{-6} for industrial soil (97 ppm to 0.97 ppm)
  - Meets the cleanup level for "low occupancy areas" under TSCA (40 CFR 761.61(a)(4)(i)(B)) and
  - Below the MDEQ proposed commercial risk-based cleanup value of 20 ppm
- The PRG of 61 ppm was selected for utility workers. A site-specific utility/construction worker exposure scenario, which includes workers in contact with soil beneath the road surface or in utility corridors, was calculated using an exposure frequency of 20 days per year, an exposure duration of 5 years, and a target risk of 1×10^{-5} (CH2M 2017). The PRG of 61 ppm will be protective of human health because it is:
  - Based on the site-specific exposure scenario with a target HI of 1 (61 ppm)
  - Within EPA's acceptable risk range of 10^{-4} to 10^{-6} based on the site-specific exposure scenario (2,100 ppm to 21 ppm)

3.3.1 Areas Exceeding Preliminary Remediation Goals in Soil

The PCB concentrations for a specific exposure unit (parkway, front yard, or back yard) are based on geostatistical sampling, which calculates a representative concentration over the entire exposure unit, not on a point-by-point concentration. This provides a more accurate assessment of human exposure for each specific exposure unit.

- The PCB PRG is 1 ppm for residential soil. Thirty-two residential exposure units, out of 84 exposure units sampled, were found to require remediation of soils exceeding the PRG. The residential exposure units with PCB concentrations above the PRG of 1 ppm are depicted in Figure 6 ([redacted], Figure 7 ([redacted]), and Figure 8 ([redacted]). Figure 7 also depicts the properties that had the TCRA removal conducted in 2014.
- The PCB PRG is 10 ppm for commercial soil. The commercial property located at [redacted] was discretely sampled; however, based on the frequency and concentration of PCBs detected, it is assumed that the top 2.5 feet would be above 10 ppm if geostatistically sampled.
- The PCB PRG is 61 ppm for utility corridor soil. Predesign studies will need to determine the total number of utility corridor exposure areas requiring cleanup.

As mentioned previously, 18 additional properties with discrete samples collected during the RI will require predesign geostatistical sampling. Predesign studies will be needed to determine the total number of properties requiring cleanup, and new properties will be sampled to refine the total number of exposure units requiring remediation as part of the remedial design. The estimated number of residential exposure units requiring remediation is 102, the estimated number of commercial properties requiring remediation is 2, and the estimated number of parkway/utility corridors exposure units is 2.

After the 2014 TCRA, PCB contamination below 4 ppm but above 1 ppm remains underneath the clean layer of fill on 6 residential exposure units (5 parkways and 1 backyard) on [redacted]. A technical review of the PCB concentrations remaining on the TCRA-remediated residential exposure units was conducted by EPA (EPA 2017). The review concluded that although PCBs above the screening criteria of 1 ppm remain on the TCRA-remediated exposure units, based on the low remaining concentrations of PCBs (less than 4 ppm) and the direct-contact barrier provided by the clean fill layer, exposure has been mitigated on those residential exposure units, and they will not be re-excavated as part of the remedial action associated with this FS.

3.4 General Response Actions Summary

Following development of RAOs and PRGs, GRAs were identified to address properties potentially having impacted media requiring remediation. As defined in the EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, *Interim Final* (EPA 1988), GRAs are media-specific actions that satisfy RAOs. Actions for mitigating potential risk posed by affected media may be applied individually or in combination. Table 3-2 summarizes the development of GRAs for achieving RAOs for soil.

Table 3-2. General Response Actions Retained for Ten-Mile Drain Near-surface soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

General Response Actions	Approach to Achieving the RAO
No action	A baseline alternative was evaluated because it is required by CERCLA. However, no action does not achieve the RAOs.
Institutional controls (ICs)	Restricts access to soil and notifies residents and workers of contamination to render human contact pathway incomplete. Process options may include an environmental covenant, deed restrictions, local ordinances and notices, fences, signs, or permits. ICs were retained for screening.
Monitoring	Monitoring of near-surface soil contaminant concentrations to evaluate the RAOs. PCBs do not degrade readily in the environment. Therefore, monitoring was not evaluated further.
Containment	Containment technologies for soil consist of low permeability caps. Caps over the soil render human contact pathway incomplete. Containment is not expected to be effective because of the thickness of the cap required to preclude potential exposure to residents during landscaping and other intrusive activities. It is also difficult to maintain containment on third-party-controlled properties. Therefore, containment was not evaluated further.
In situ treatment	In situ treatment involves removing contaminants without removing the soil matrix. In situ treatments are marginally effective when addressing PCBs in near-surface soil. Examples of in situ treatment include thermal desorption. In situ treatment was not further.
Ex situ treatment	Ex situ treatment involves removing the soil followed by contaminant removal. Examples of ex situ treatment include stabilization after the soil has been excavated, soil washing, and chemical extraction. Because of the limited working space in a residential area, ex situ treatment was determined to be ineffective and not evaluated further.
Excavation and Disposal	Excavation and disposal involves excavating the soil and disposing of the soil offsite at a licensed TSCA or Resource Conservations and Recovery Act Subtitle D landfill. Excavation and disposal was retained for screening.

3.5 Technologies and Process Options Summary

Within each remaining GRA, remedial technologies were identified and screened based on effectiveness, implementability, and relative cost. The criteria are as follows:

- **Effectiveness** is the ability of the technology or process option to perform adequately to achieve the remedial objectives alone or as part of an overall system.
- **Implementability** refers to degree of difficulty expected in implementing a particular measure under practical technical, regulatory, and schedule constraints.
- **Relative cost** is comparative only and is judged similarly to the effectiveness criterion. It is used to preclude further evaluation of process options that are very costly where there are other choices that perform similar functions with comparable effectiveness. It includes construction and long-term operations and maintenance (O&M) costs.

The screening of remedial technologies is presented in Table 3-3. The technologies and process options considered infeasible based on effectiveness, implementability, and costs are shown in shaded background. Screening was based on professional experience, published sources, and other relevant documentation. The following technology/options were retained for further consideration:

- ICs
- Excavation and Disposal at TSCA or Resource Conservation and Recovery Act (RCRA) Subtitle D Solid Waste Landfill.

3.6 Remedial Alternatives

The technologies that remained following screening were assembled into remedial alternatives that meet RAOs and satisfy ARARs. The specific details of the remedial components discussed for each alternative are intended to serve as representative examples.

The preliminary remedial alternatives identified for the near-surface soils at TMD include the following:

- Alternative 1, No Action
- Alternative 2, Soil Excavation of Near-surface soils Exceeding PRGs, Offsite Disposal, Backfill, ICs (if necessary), and Site Restoration

3.6.1 Alternative 1—No Action

Alternative 1 consists of taking no action. The NCP requires that a no-action alternative be retained throughout the FS process as a baseline for comparison to the other approaches. The no-action alternative would leave PCB-impacted soil in place at the site. There are no capital or O&M costs associated with Alternative 1. However, the NCP requires 5-year site reviews as long as hazardous substances remain at the site at concentrations that do not allow unlimited use and unrestricted exposure.

Table 3-3. Remedial Technology Screening - Near-surface soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Remedial Technology	Process Options	Descriptions	Effectiveness	Implementability	Relative Cost Range	Screening Comment
No Action						
None	None	No action	The "No Action" approach does not achieve the RAO.	Good	Zero	Required for comparison.
Institutional Control						
Access and Use Restrictions	Deed restrictions	Issue deed restrictions for property with soils exceeding the PRGs, restricting land use. May be used in conjunction with other GRAs.	Effective at maintaining potential exposure associated with land use. Effectiveness is also directly proportional to ability to implement, manage and enforce. ICs do not prevent contaminant migration or reduce contaminant concentrations.	Implementability is dependent on the cooperation of individual property owners.	Unknown. Property owners may want compensation for lost use or diminished property value.	Retained for further evaluation.
In Situ Treatment						
Thermal	Thermal Treatment	Install a thermal treatment system, which would increase soil temperatures, allowing PCBs to desorb from the soil and be removed by capturing and disposing of the vapors.	Medium	Poor – large amount of infrastructure necessary, large area needed for thermal equipment, multiple areas need to be treated	High	Not retained because of high costs of construction and implementation, multiple remediation areas and location within residential neighborhoods.

Table 3-3. Remedial Technology Screening - Near-surface soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Remedial Technology	Process Options	Descriptions	Effectiveness	Implementability	Relative Cost Range	Screening Comment
Excavation and Disposal						
Excavation and Disposal	Excavation and disposal of soil at TSCA or RCRA solid waste Subtitle D Landfill	Excavate PCB impacted soils using common earthwork equipment. Permanently dispose of soil in a TSCA or RCRA-permitted landfill	Highly effective because contaminants are removed and soil can be easily sampled before or during excavation to verify that PRGs are met. Permitted landfills are rigorously designed and operated to contain disposed wastes.	Excavation is relatively simple, well proven and readily implementable. Subtitle D landfills are locally present. TSCA-permitted landfills require greater transportation distances.	Moderate	Retained for further evaluation.

Notes:
Shaded technologies are screened from further consideration in the assembly of remedial action alternatives.
Effectiveness is the ability to perform as part of an overall alternative that can meet the objective under conditions and limitations that exist onsite.
Implementability is the likelihood that the process could be implemented as part of the remedial action plan under the physical, regulatory, technical, and schedule constraints.
Relative cost is for comparative purposes only and it is judged relative to the other processes and technologies that perform similar functions.

3.6.2 Alternative 2—Soil Excavation of Near-surface soils Exceeding PRGs, Offsite Disposal, Backfill, Institutional Controls (If necessary), and Site Restoration

Alternative 2 consists of excavating the near-surface soil with total PCB concentrations exceeding PRGs, followed by offsite disposal at a RCRA solid waste Subtitle D landfill or TSCA-permitted landfill if soil concentrations are above 50 ppm (commercial property). Soil excavation depth will be predetermined based on geostatistical sampling; therefore, no verification samples will be collected. Excavations have a maximum depth of 2.5 feet bgs. The excavation will then be backfilled with uncontaminated offsite soil and restored to its original condition, to the extent practicable.

ICs or a visual barrier will be considered for properties where COC concentrations exceed PRGs in soil below 2.5 feet. The analytical results from surface soil samples collected during the investigations indicate that PCB concentrations decrease with depth at both the residential and commercial properties and the highest concentrations were typically found within 2.5 feet of ground surface; therefore, exceedances above PRGs below 2.5 feet are not anticipated. In isolated cases where COC concentrations are found to exceed PRGs in soil below 2.5 feet, consideration will be given on a case-by-case basis to conduct additional excavations in order to remove impacts and avoid the need for ICs or visual barrier. EPA will evaluate whether there continues to be a need for ICs at the 5-year review period to see if access circumstances have changed for any parcels where ICs were desired, but not obtained.

Following are the primary components of Alternative 2:

- Conducting predesign sampling using a geostatistical sampling approach on additional residential yards and parkways/utility corridor and additional commercial properties that were discretely sampled during the RI and not previously sampled to verify the CSM, determine excavation limits, and identify the number of decision units that require remediation.
- Predesign sampling to determine if PCB concentrations exceeding cleanup levels are present in soil at depths greater than 2.5 feet bgs.
- Predesign sampling to identify properties where ICs and/or a visual barrier may be needed after the upper 2.5 feet of soil are removed.
- Excavating contaminated utility corridor soils exceeding PRGs to maximum depth of 6 feet.
- Excavating contaminated residential and commercial surface soils exceeding PRG to maximum depth of 2.5 feet bgs.
- In cases where the predesign results indicate that PCB concentrations exceed cleanup levels in soil deeper than 2.5 feet bgs, limited additional soil may be excavated if determined to be more cost effective than implementing ICs, installing a visual barrier, and/or needing to conduct 5-year reviews at residential properties.
- Transporting and disposing of the excavated soil at a permitted RCRA solid waste Subtitle D (soils below 50 ppm PCBs) or TSCA landfill (soils above 50 ppm PCBs).
- Backfilling excavation with uncontaminated offsite backfill soil and topsoil.
- Placing demarcation fabric or other visual barrier below the clean fill material at properties identified during the predesign sampling where COC concentrations below 2.5 feet exceed the PRGs, if necessary.
- Restoring the site to original conditions, to the extent practicable.
- Implementing ICs, if necessary.

For this alternative to be implementable, the following assumptions have been made:

- An access agreement or other agreement between EPA and the current property owners can be obtained to allow for the predesign sampling and excavation of soil.
- In the absence of an access agreement or other agreement between EPA and the current property owner to allow for predesign sampling and excavation of soil, an agreement between EPA and the current property owner can be reached for an IC on the property, if necessary.

SECTION 4

Detailed Analysis of Remedial Alternatives

The remedial alternatives represent a range of strategies that address COCs in soil that present a potential risk to human health. The following subsections provide a detailed analysis of the two alternatives against evaluation, threshold, and balancing criteria.

4.1 Evaluation Criteria

The evaluation criteria allow comparison of the relative performance of the alternatives and provide a means for identifying their relative advantages and disadvantages. In accordance with the NCP, remedial actions must accomplish the following:

- Protect human health and the environment.
- Attain ARARs or provide grounds for invoking a waiver of ARARs that cannot be achieved.
- Be cost-effective.
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element.

The NCP also emphasizes long-term effectiveness and related considerations, including the following:

- Long-term uncertainties associated with land disposal
- Goals, objectives, and requirements of the Solid Waste Disposal Act
- Persistence, toxicity, and mobility of hazardous substances and their constituents and their propensity to bioaccumulate
- Short- and long-term potential for adverse health effects from human exposure
- Long-term maintenance costs
- Potential for future remedial action costs if the selected remedial action fails
- Potential threat to human health and the environment associated with excavation, transportation, disposal, or containment

Provisions of the NCP require that each alternative be evaluated against the nine criteria listed in 40 CFR 300.430(e)(9). These criteria were published in the *Federal Register* (55 F*ederal Register* [March 8, 1990]: 8666) to provide grounds for comparison of the relative performance of the alternatives and to identify their advantages and disadvantages. This approach is intended to provide sufficient information to compare alternatives and to select the most appropriate alternative for implementation at the site as a remedial action. Seven of the following nine criteria were evaluated in the detailed analysis:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

- State acceptance (not evaluated at this time)
- Community acceptance (not evaluated at this time)

State acceptance and community acceptance criteria will be evaluated by addressing comments received after MDEQ and the public have reviewed site documents (for example, the RI report, FS report, and proposed plan). This evaluation will be presented in the Responsiveness Summary of the ROD.

The evaluation criteria are divided into three groups: threshold, balancing, and modifying criteria. Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria—either the alternative meets the criteria or it is considered unacceptable. The two threshold criteria are overall protection of human health and the environment, and compliance with ARARs. If ARARs cannot be met, a waiver may be obtained when one of the six exceptions listed in the NCP occurs (40 CFR 300.430 (f)(1)(ii)(C)(1 to 6)).

Unlike the threshold criteria, the five balancing criteria weigh the tradeoffs between alternatives. A low rating on one balancing criterion can be offset by a high rating on another. The five balancing criteria are as follows:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

The modifying criteria are community and state acceptance. They are evaluated following the public comment period and used to modify the selection of the recommended alternative.

4.2 Threshold Criteria

Threshold criteria are standards that an alternative must meet to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria. If ARARs cannot be met, a waiver may be obtained where one or more site exceptions occur as defined in the NCP.

4.2.1 Overall Protection of Human Health and the Environment

Protectiveness is the primary requirement that remedial actions must meet under CERCLA. It is an assessment of whether each alternative achieves and maintains adequate protection of human health and the environment. A remedy is protective if it eliminates, reduces, or controls all current and potential risks posed by the site through each exposure pathway. Adequate engineering controls, land use controls, or some combination of the two can be implemented to control exposure and thereby ensure reliable protection of human health and the environment over time. In addition, implementation of a remedy cannot result in unacceptable short-term risks or cross-media impacts on human health and the environment.

4.2.2 Compliance with ARARs

Compliance with ARARs is a statutory requirement of remedy selection. This criterion is used to determine whether the selected alternative would meet the federal, state, and local ARARs identified in Section 3.1.

4.3 Balancing Criteria

Balancing criteria are used to weigh tradeoffs between alternatives. They represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. A high rating on one generally can compensate for a low rating on another.

4.3.1 Long-term Reliability and Effectiveness

Long-term reliability and effectiveness reflects CERCLA's emphasis on implementing remedies that will protect human health and the environment in the long term. Under this criterion, results of a remedial alternative are evaluated in terms of the potential risk remaining at the site after response objectives are met. The primary focus of the evaluation is the extent and effectiveness of the actions or controls that may be required to manage the potential risk posed by treatment residuals or untreated wastes.

Factors to be considered and addressed in a detailed evaluation of remedial alternatives are the magnitude of residual risk, adequacy of controls, and reliability of controls. Magnitude of residual risk is the assessment of the risk remaining from untreated waste or treatment residuals after remediation. Adequacy and reliability of controls is the evaluation of the controls that can be used to manage treatment residuals or untreated wastes that remain onsite.

4.3.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion addresses the statutory preference for remedies that employ treatment to significantly reduce the toxicity, mobility, or volume of the hazardous substances. The preference is satisfied when treatment is used to reduce the principal threats at a site by destroying toxic chemicals or reducing the total mass or total volume of affected media. This criterion is specific to evaluating only how the treatment reduces toxicity, mobility, and volume. Specifically, the analysis will examine the magnitude, significance, and irreversibility of reductions. It does not address containment actions, such as capping.

4.3.3 Short-term Effectiveness

This criterion examines the short-term impacts associated with implementing the alternative. Implementation may affect workers, the neighboring community, or the surrounding environment. Short-term effectiveness also includes the following: potential threats to human health and environment associated with excavation, treatment, and transportation of hazardous substances; potential cross-media impacts of the remedy; and the time required to achieve protection of human health and the environment.

4.3.4 Implementability

Implementability considerations include technical and administrative feasibility of the alternatives, as well as the availability of goods and services (including treatment, storage, or disposal capacity) associated with the alternative. Implementability considerations often affect the timing of remedial actions (for example, limitations on the season in which the remedy can be implemented, the number and complexity of material handling steps, and the need to secure technical services). Onsite activities must comply with the substantive parts of applicable permitting regulations.

4.3.5 Cost

The detailed cost analysis of alternatives includes capital and annual O&M costs incurred over a period of 30 years in accordance with EPA guidance *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002; EPA 2000). The focus during the detailed analysis is on the net present value, or present worth, of the costs. Costs are used to select the most cost-effective alternative that will achieve the RAOs.

The cost estimates were prepared with an accuracy in the range of -30 to +50 percent. However, the exact accuracy of each total cost estimate depends on the assumptions made and the availability of costing information. Based on the number of residential exposure units geostatistically sampled that contain PCBs at concentrations exceeding 1 ppm (32 exposure units), it is estimated that approximately 102 residential exposure units will require remediation. The average size of the 32 residential exposure units that have been geostatistical sampled is 1,207 square feet, and the average volume of soil to be removed is 68.6 cubic yards. The cost per average exposure unit was extrapolated for 102 exposure units to estimate the overall cost of the residential exposure unit remediation. For estimating purposes, it is also assumed that two parkway/utility corridors exposure units will require remediation. The cost for each parkway/utility corridor remediation is equivalent to the average residential exposure unit. One commercial property, [redacted], has PCB concentrations above 10 ppm. The estimated area for [redacted] is 19,200 square feet, and the estimated soil volume to be remediated is 1,778 cubic yards. For estimating purposes, it is assumed that a second commercial property will require remediation. The estimated size of the second (adjacent) commercial property is 10,535 square feet, and the estimated volume of soil to be remediated is 975 cubic yards.

4.4 Modifying Criteria

Modifying criteria are evaluated by addressing comments received after the regulatory agencies and the public have reviewed the FS and proposed plan. This evaluation will be presented in the responsiveness summary of the ROD.

4.4.1 State Acceptance

This criterion evaluates the technical and administrative issues and concerns the state may have regarding the alternatives. The concern will be addressed in the ROD upon receiving comments on the RI/FS report and the proposed plan.

4.4.2 Community Acceptance

This criterion evaluates the issues and concerns the public may have regarding the alternatives. The concerns will be addressed upon receiving comments documented during the public comment period.

SECTION 5

Individual Alternative Analysis

A detailed evaluation of the alternatives with respect to the seven evaluation criteria is presented in the following subsections. A remedial alternative evaluation summary of each alternative is presented in Table 5-1.

5.1 Alternative 1—No Action

Under Alternative 1, no action would be taken to contain or treat COC concentrations exceeding PRGs in the near-surface soils at the TMD site. The No-Action Alternative is required by the NCP and serves as the baseline against which all other remedial alternatives are judged.

5.1.1 Overall Protection of Human Health and the Environment

Under Alternative 1, no physical remedial actions would be implemented. As a result, there would be no measurable reduction in potential human health risks from PCB concentrations exceeding PRGs in soil. Because the FS focus area is in a primarily residential setting with direct exposures to PCB concentrations exceeding the risk-based PRGs, this alternative would not protect human health or the environment.

5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 does not comply with the requirements of CERCLA because there would be no remediation to protect human health.

5.1.3 Long-term Effectiveness and Permanence

Potential risk would persist in the near-surface soils at the TMD site under Alternative 1 because receptors could come into contact with PCB concentrations exceeding PRGs in soil. In addition, where soils are exposed, PCBs could be released with windborne dust or by stormwater runoff. There would be no reliability of controls because no ICs or land use controls are associated with this alternative.

5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not provide physical treatment processes for toxicity, mobility, or volume reduction of contaminated media. Because there is no physical treatment process, there would be no treatment residuals. Alternative 1 would not satisfy the statutory preference for treatment.

5.1.5 Short-term Effectiveness

Because Alternative 1 requires no construction, there would be no construction-related risks to workers, the community, or the environment. Protection of human health would not be achieved because of the lack of natural attenuation of PCBs. PCB concentrations could remain onsite indefinitely. Five-year reviews would be required as COC concentrations exceeding the PRGs in soil would remain onsite.

5.1.6 Implementability

The technical feasibility of Alternative 1 is not applicable because no action would be implemented. The availability of services, materials, and technologies also is not applicable.

5.1.7 Cost

Periodic costs for preparing 5-year reviews are associated with Alternative 1. The net present value is $95,000.

5.2 Alternative 2—Soil Excavation and Offsite Disposal of Soils Exceeding PRGs, Backfill, Institutional Controls, and Site Restoration

Alternative 2 consists of excavation of residential and commercial surface soil up to 2.5 feet bgs and utility corridor soil up to 6 feet bgs with PCB concentrations exceeding PRGs, followed by offsite disposal at an RCRA Subtitle D landfill for residential properties and a TSCA landfill for commercial and utility corridor properties. The excavation will then be backfilled with uncontaminated offsite fill material and restored to its original condition. Predesign sampling activities will verify the depth of PCB contamination greater than the PRG and identify properties where ICs may be implemented after the upper 2.5 feet of soil are removed. Therefore, soil confirmation samples will not be required.

Alternative 2 has the following primary components:

- **Community Relations**—Property owners will be notified of the pending predesign sampling and remediation efforts and will be required to sign a "Consent to Access Property" agreement to support access for both the predesign sampling and, if necessary, subsequent remediation. If a property owner is unwilling to consent to access for remedial action, local permit restrictions, deed notices, and/or other ICs will be enforced by EPA.

  Community relations outreach will consist of communications by newspaper and fact sheet mailings, door-to-door visits with affected property owners, and public meetings.

- **Predesign Soil Sampling**—Predesign geostatistical sampling at individual residential exposure units that were discretely sampled or not sampled during previous sampling events to determine the number of exposure units that require remediation.

- **Mobilization, Utility Locates, and Storage/Staging/Laydown Areas**—Remediation will be conducted at properties identified in Section 3.3.1, as well as new properties requiring remediation based on results of predesign sampling. Prior to mobilization for remediation, property owners will be responsible for moving non-permanent items from the exposure unit that will be remediated. Shrubs and trees that will be removed during construction activities will be inventoried. Utilities within the proposed excavation areas will be marked and, if required, temporarily relocated. Hand-digging will be performed to the extent practicable to prevent the removal of large trees and damage to underground utilities. Storage for equipment, staging for backfill material, and/or laydown areas will be located at EPA-approved properties within or near the neighborhood, following individual owner acceptance. The areas will be secured with a minimum 6-foot-tall temporary security fence and appropriate signage.

- **Preconstruction and Post-Construction Survey**—Preconstruction and post-construction surveys will be performed to confirm excavation and restoration are completed to the appropriate grade and to restore the property to its elevation. Fencing and gates will be removed, as appropriate, to allow construction equipment into the required areas. Hand-digging will be performed in areas inaccessible for construction equipment.

- **Extents and Method of Excavation and Placement of Demarcation Fabric**—Based on the geostatistical sample data, soil from residential and commercial exposure units with PCB concentrations exceeding PRGs will be excavated to a maximum depth of 2.5 feet. Depending on

predesign sample data, soil from utility worker exposure units with PCB concentrations exceeding PRG will be excavated. The horizontal extent of the excavation will be defined by the surveyed property boundaries and permanent structures, such as a building, paved areas, decks, sidewalks, small sheds, or aboveground pools. The excavations will have a 1:1 slope away from permanent structures.

Excavated soils will be live-loaded and transported for offsite disposal at an EPA-approved, permitted RCRA subtitle D landfill for residential soils and an EPA-approved TSCA-permitted landfill for the commercial and utility corridor properties.

- **Uncontaminated Fill Material and Restoration**—Uncontaminated offsite general fill material and topsoil, minimum of 6 inches, will be placed to return the properties to their original grade. The final graded surface will be covered with sod. Replacement shrubs and trees will be planted and fences and gates will be reinstalled or replaced unless not elected by the property owner.
- **ICs**—ICs will be considered for properties where PCB concentrations exceed PRGs in soil deeper than 2.5 feet bgs, or where properties where soils exceed PRGs and owners deny access for remedial action. EPA will evaluate whether there continues to be a need for ICs at the 5-year review period to see if access circumstances have changed for any parcels where ICs were desired, but not obtained.

  ICs could include environmental covenants, zoning restrictions, building/excavation permits, or deed notices. Zoning restrictions or building/excavation permits can be effectively managed within existing City building permit, planning, and zoning departments.

5.2.1 Overall Protection of Human Health and the Environment

Surface soil with PCB concentrations exceeding the PRG of 1 ppm on residential properties and 10 ppm on commercial properties, will be removed up to a maximum depth of 2.5 feet. Activities of residents at residential properties, such as gardening and landscaping, typically do not extend below a depth of 2.5 feet. The excavation depth of 2.5 feet and 2.5 feet of uncontaminated fill material will prevent direct human contact and exposure to residual contamination for those types of activities. Additionally, soils with PCB concentrations exceeding the PRG of 61 ppm within utility corridors will be removed to a maximum depth of 6 feet (does not include the TMD storm sewer which is addressed in the sitewide FS). Following site restoration, this alternative is protective of human health by eliminating the direct contact pathway. If property owners deny access for remedial actions, a potential risk would still be present at these properties. ICs may be considered for any properties where access could not be obtained; however, ICs alone are considered to be marginally effective for properties exceeding PRGs in the upper 2.5 feet of soil.

5.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

ARARs will be met with the implementation of Alternative 2.

5.2.3 Long-term Effectiveness and Permanence

Alternative 2 will be effective over the long-term because soils with COC concentrations exceeding PRGs in the upper 2.5 feet will be removed from the site and replaced with clean materials. If required, placement of a high-visibility permeable and permanent demarcation fabric placed at the base of the excavations will also serve as a visual barrier to reduce the potential risk of contact with COC concentrations exceeding PRGs in soil below 2.5 feet. Upon establishment of vegetation, erosion would be minimized.

If required, ICs may be implemented for properties where COC concentrations exceeding PRGs in soil remain at depth. ICs would increase the long-term effectiveness and permanence by minimizing the potential for future disturbance of soil with COC concentrations exceeding PRGs below 2.5 feet presenting an unacceptable potential risk. Potential ICs could include environmental covenants, zoning

restrictions, building/excavation permits, or deed notices. Zoning restrictions or building/excavation permits can be effectively managed within existing City building permit, planning, and zoning departments. However, ICs would be less effective over the long-term for properties with remaining COC concentrations exceeding PRGs in surface soil where property owners denied access for remedial action. Limiting typical activities such as gardening and landscaping through an IC can be challenging to enforce.

Five-year reviews would be required if COC concentrations exceed the PRGs in soil below a depth of 2.5 feet or where property owners denied access for remedial action.

5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2 does not employ treatment of the contaminated material, so there would be no reduction of toxicity, mobility, or volume through treatment. Soils are not listed hazardous waste and are not expected to be characteristically hazardous. Alternative 2 does not satisfy EPA's statutory preference for remedial actions that employ treatment technologies as their principal element.

5.2.5 Short-term Effectiveness

Alternative 2 meets the short-term effectiveness criterion because risks will be controlled or mitigated by preventative measures identified within relevant project plans.

Trucks required to haul excavated materials offsite and to import uncontaminated fill would affect residents and neighboring communities under Alternative 2. Residents and construction workers could be exposed to contaminated airborne dust particles if excavation occurs during dry conditions. Dust-suppression measures would be required. Additional short-term risks to workers include occupational construction risks associated with equipment. Such risks would be mitigated by site-specific health and safety measures, a traffic control plan, and a construction quality assurance plan. Potential impacts from soil excavation are related largely to the potential for runoff to infiltrate the stormwater drainage system. Stormwater erosion will be mitigated by implementing environmental control plan measures and with the use of erosion and sediment controls and good housekeeping practices.

The PRGs will be met in soils to 2.5 feet upon completion of the excavation, which is estimated to take 6 months for the remedial action construction, restoration, and watering for Alternative 2.

5.2.6 Implementability

Alternative 2 is implementable. The most critical factors are community acceptance, obtaining access agreements from property owners, and implementing ICs, where required. Upon completion of remedial actions, ICs may be considered where PCB concentrations exceed 1 ppm in residential and 10 ppm in commercial soil at depths below 2.5 feet and where property owners denied access for remedial actions. Depending on the ICs selected, coordinating with a number of property owners could pose an implementability challenge.

5.2.7 Cost

Costs for Alternative 2 associated with predesign sampling, excavation, transportation, and disposal of excavated soil, placement of uncontaminated offsite fill and topsoil, restoration, and watering are based on the estimated soil volumes and disturbed surface areas. Five-year reviews will be required for properties where RAOs were not met because of property owner access refusal and PCB concentrations exceeding 1 ppm on residential, 10 ppm on commercial properties in soil below 2.5 feet, and 61 ppm in utility corridors. ICs will be considered for properties where PCB concentrations exceed 1 ppm in soil below 2.5 feet.

Alternative 2 is estimated to be completed over a period of 6 months. Discount rates of 1.4 percent over 5 years are applied to ICs and 5-year reviews, which will be performed over an assumed 30-year period.

The total present worth is estimated to be $6,338,000 for the residential properties and $1,445,000 for the two commercial properties, for a total of $7,783,000 for Alternative 2. The cost estimate for Alternative 2 is presented in Appendix A.

Table 5-1. Remedial Alternative Evaluation Summary—Near-Surface Soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Soil Excavation and Offsite Disposal of Soils Exceeding PRGs, ICs, Backfill, and Site Restoration
Protection of human health and the environment	Not protective	Protective
Location-specific ARARs	Not in compliance	In compliance
Action-specific ARARs	Not in compliance	In compliance
Magnitude of residual risk	Residual risk remains	Low residual risk for soils remaining below 2.5 feet.
Adequacy and reliability of controls	No controls	Adequate and reliable
Need for 5-year review	Required	Required if COC concentrations exceeding PRGs remain in soil at depth or if access for remedial action is denied by property owner
Treatment processes used and materials treated	None	None
Amount of hazardous material destroyed or treated	None	None
Expected reduction in toxicity, mobility, or volume of the waste	None	None
Irreversibility of treatment	Not applicable	Not applicable
Type and quantity of residuals that will remain following treatment	Not applicable	Not applicable
Statutory preference for treatment	Does not satisfy	Does not satisfy
Protection of workers during remedial action	Not applicable	Moderate
Protection of the community during remedial action	Not applicable	Moderate
Potential environmental impacts of remedial action	Not applicable	Low
Time until protection is achieved	Protection not achieved	Less than 1 year
Technical feasibility	Not applicable	High
Reliability of technology	Not applicable	Very reliable
Administrative feasibility	Not applicable	Feasible
Availability of services, equipment, and materials	Not applicable	Readily available

Table 5-1. Remedial Alternative Evaluation Summary—Near-Surface Soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Cost[a,b]		
Capital cost	$0	$7,688,000
Present worth O&M	$95,000	$95,000
Capital and present worth O&M	$95,000	$7,783,000

Notes:

Costs are estimated for 2017.

The cost estimates presented herein were developed strictly for comparing the alternatives. The final costs of the project and the resulting feasibility will vary from the cost estimates depending on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, the firm selected for final engineering design, and other variables. Because of these factors, project feasibility and funding needs must be reviewed before specific financial decisions are made or project budgets are established to help ensure proper project evaluation and adequate funding. The cost estimates are order-of-magnitude estimates having an intended accuracy range of +50 to -30 percent. The range applies only to the alternatives as they are defined in Section 3.6 and does not account for changes in scope. Selection of specific technologies or processes to configure remedial alternatives is intended not to limit flexibility during remedial design, but to provide a basis for preparing cost estimates. The specific details of remedial actions and cost estimates would be refined during final design.

[a] Based on EPA 2000.

[b] Cost estimate is provided in Appendix A.

5.3 Comparative Analysis

The purpose of the comparative analysis is to identify the relative advantages and/or disadvantages of each remedial action alternative within the categories listed. The NCP is the basis for the detailed comparative analysis. Table 5-2 summarizes the comparative analysis.

Table 5-2. Comparative Analysis of Remedial Alternatives—Near-Surface Soils
Feasibility Study Residential and Commercial Near-surface soils
Ten-Mile Drain Superfund Site, St. Clair Shores, Michigan

Criteria	**Alternative 1: No Action**	**Alternative 2: Soil Excavation and Offsite Disposal of Soils Exceeding PRGs, Backfill, ICs, and Site Restoration**
Overall Protection of Human Health and the Environment	1	3
Compliance with ARARs	1	4
Long-term Effectiveness and Permanence	1	4
Reduction of Toxicity, Mobility, or Volume Through Treatment	1	1
Short-term Effectiveness	1	3
Implementability	4	4
Cost	4	3

Note:

1—Poor, 2—Satisfactory, 3—Good, 4—Excellent

5.3.1 Overall Protection of Human Health and the Environment

Alternative 1, no action, is not protective of human health and the environment. Alternative 2 is considered protective of human health. Alternative 2 relies on a combination of excavation, transport and disposal, backfill of uncontaminated fill and restoration, and ICs, if required, to meet the RAOs. Alternative 2 is permanent and protective; however, COC concentrations exceeding PRGs may remain at depth.

5.3.2 Compliance with ARARs

Alternative 1 does not comply with ARARs. Alternative 2 is expected to comply with ARARs.

5.3.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide long-term effectiveness and permanence. Alternative 2 does provide long-term effectiveness and permanence by removing the PCB-impacted soil and replacing it with uncontaminated backfill material.

5.3.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 1 does not provide any reduction of toxicity, mobility, and volume through treatment. Alternatives 2 does not include treatment technologies; therefore, it is not expected to provide a reduction in toxicity, mobility, and volume through treatment. Soils are not listed hazardous waste and are not expected to be characteristically hazardous. However, soil excavated from the commercial property located at [redacted] will likely require disposal at a TSCA-permitted landfill.

5.3.5 Short-term Effectiveness

Alternative 1 has no impact on short-term effectiveness as no construction activities are implemented. Alternative 2 will have short-term effects on the community because of disruptions caused by remediation activities. Short-term impacts associated with protection of workers, the community, or the environment during remedial construction can be reduced by implementing best management practices during remediation activities.

5.3.6 Implementability

Alternatives 1 and 2 can be implemented with readily available materials and methods.

5.3.7 Cost

A detailed cost analysis of the estimated costs for each of the alternatives is presented in Appendix A. The estimated capital, O&M, and present net-worth costs are summarized in Table 5-1.

Alternative 1 has a present worth cost of $95,000. Alternative 2 has a cost of $7,783,000.

SECTION 6

Summary

The objective of the FS was to develop and evaluate remedial alternatives that will address human health risks from PCBs present in the near-surface soils at the TMD Superfund site. Remedial technologies and process options were screened for the purpose of identifying preliminary remedial alternatives. Two alternatives: Alternative 1—No Action and Alternative 2—Soil Excavation and Offsite Disposal of Soils Exceeding PRGs, Backfill, ICs, and Site Restoration were developed, evaluated, and comparably ranked. Only two alternatives were carried through and comparably ranked because of the limited GRAs that would be feasible in a residential setting to remediate this type of near-surface contamination.

The comparative analysis of the alternatives included evaluating the effectiveness, implementability, and cost of each. The evaluation of effectiveness included reviewing the protectiveness of the alternative; compliance with ARARs; long-term effectiveness and permanence; reduction in toxicity, mobility, or volume; short-term effectiveness; and its ability to meet the RAOs. Implementability included the evaluation of the technical feasibility, availability, and administrative feasibility of the alternatives. The evaluation of cost included a review of capital costs and total net present values of each alternative.

Based on the alternatives evaluated in this FS, Alternative 1—No Action, is not protective of human health and the environment. Alternative 2 would be protective below the human health action levels identified in the HHRA. A recommended alternative will be presented in the proposed plan.

SECTION 7

References

CH2M HILL, Inc. (CH2M). 2011. *2011 Source Area Investigation*, *Ten Mile Drain Site, Data Summary Report, St. Clair Shores, Michigan.* January.

CH2M HILL, Inc. (CH2M). 2016a. *2016 Draft Remedial Investigation*, *Ten Mile Drain Site, St. Clair Shores, Michigan.* May.

CH2M HILL, Inc. (CH2M). 2016b. *Human Health Risk Assessment, Ten Mile Drain Site, St. Clair Shores, Michigan.* February.

CH2M HILL, Inc. (CH2M). 2016c. *Screening Level Ecological Risk Assessment, Ten Mile Drain Site, St. Clair Shores, Michigan.* February.

CH2M HILL, Inc. (CH2M). 2017. *Preliminary Remediation Goals for PCBs in Utility Corridor Soil, St. Clair Shores, Macomb County, Michigan.* July.

Natural Resource Conservation Service (NRCS). 2013. Soil Survey Area: Macomb County, Michigan [Version 8]. http://websoilsurvey.nrcs.usda.gov. Accessed December 19, 2013.

U.S. Environmental Protection Agency (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final.*

U.S. Environmental Protection Agency (EPA). 1994. National Oil and Hazardous Substances Pollution Contingency Plan.

U.S. Environmental Protection Agency (EPA). 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study.* EPA 540-R-00-002.

U.S. Environmental Protection Agency (EPA). 2004. Federal On-Scene Coordinator's Report. August.

U.S. Environmental Protection Agency (EPA). 2012. *Lange and Revere Street Canals Sediment Sampling Report*. June.

U.S. Environmental Protection Agency (EPA). 2014. Removal Letter Report for St. Clair Shores PCB Drain Removal #2. August 8.

U.S. Environmental Protection Agency (EPA). 2015. *Regional Screening Levels for Chemical Contaminants at Superfund Sites and the CERCLA Guidance on Land Use in the CERCLA Remedy Selection Process*. November.

U.S. Environmental Protection Agency (EPA). 2017. *Technical review of PCB cleanup level in residential yards and parkways for the Ten Mile Drain Site*. January.

Weston Solutions. 2007. St. Clair Shores PCB Site*, St. Clair Shores, Macomb County, Michigan.* May.

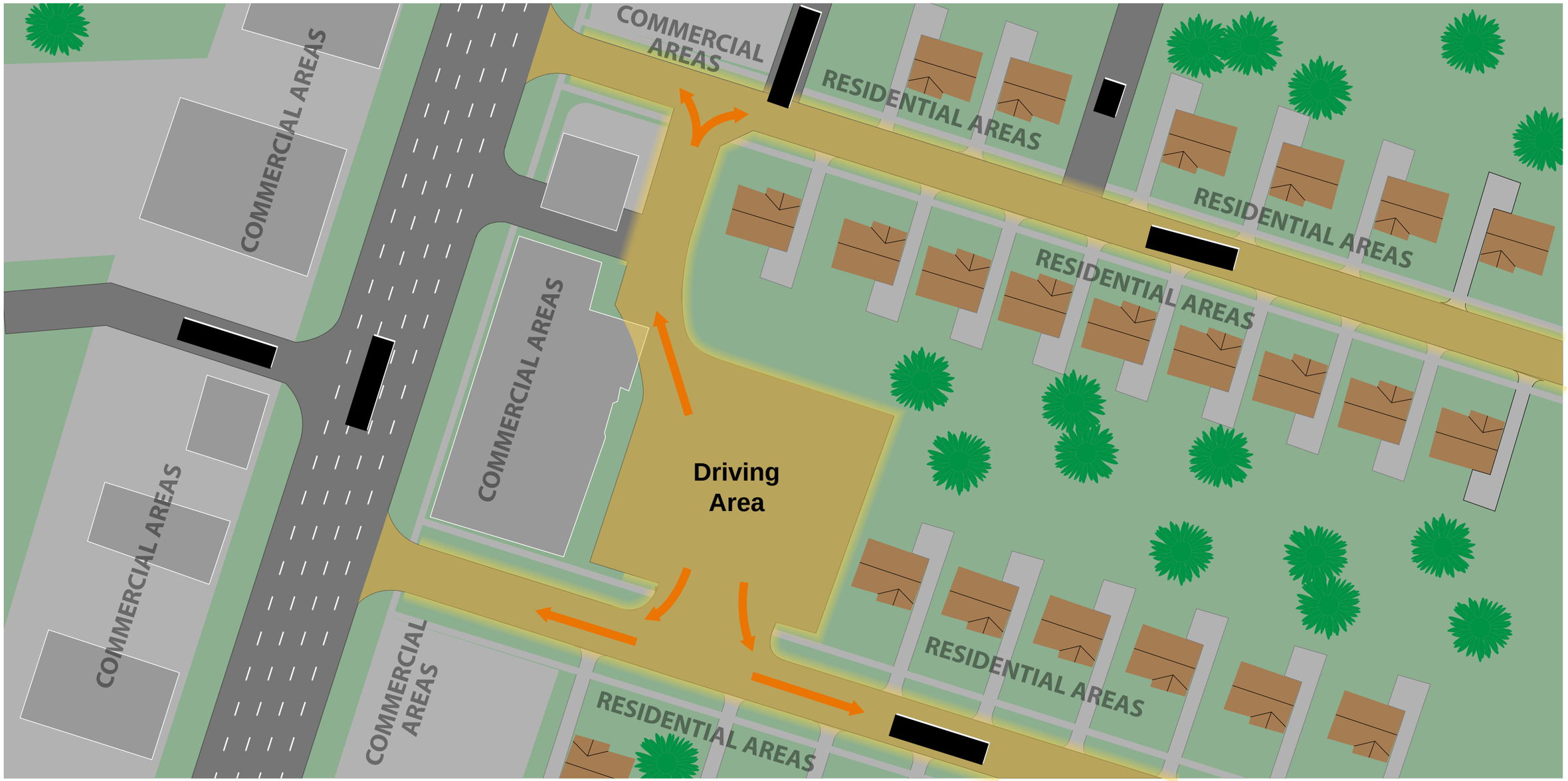
Weston Solutions. 2010. Bon Brae/Harper Site Removal Action*, St. Clair Shores, Macomb County, Michigan.* June.

Figures

Note:
Aerial May 9, 2010

FIGURE 1
Site Location
Technology and Remedial Alternatives
Screening for Ten-Mile Drain Superfund Site
Saint Clair Shores, Michigan

\\brookside\gis_share\ENBG\00_Proj\E\EPA\SaintClairShores\MXDs\2017\Figure1_FormerMartinDrain.mxd 7/13/2017



North

0 50 100

Approximate scale in feet

Note: This is a contaminant pathway model only and is not intended to represent actual conditions at specific property locations.

LEGEND

Surface Soil Track Out Study Area

FIGURE 2
Surface Soil Contamination Model
Focused Feasibility Study
Residential and Commercial Near Surface Soils
Ten-Mile Drain Superfund Site
St. Clair Shores, Michigan

ch2m

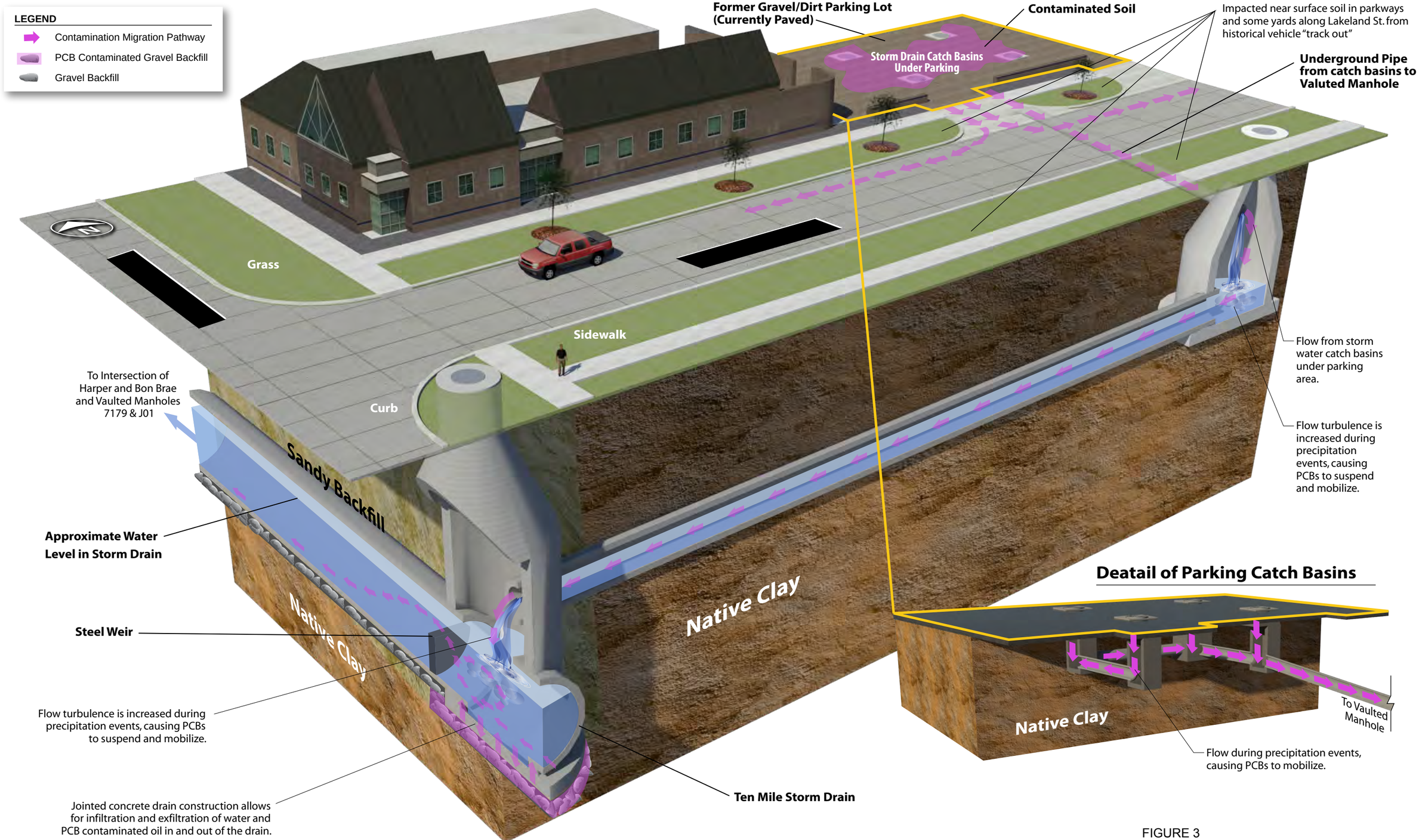
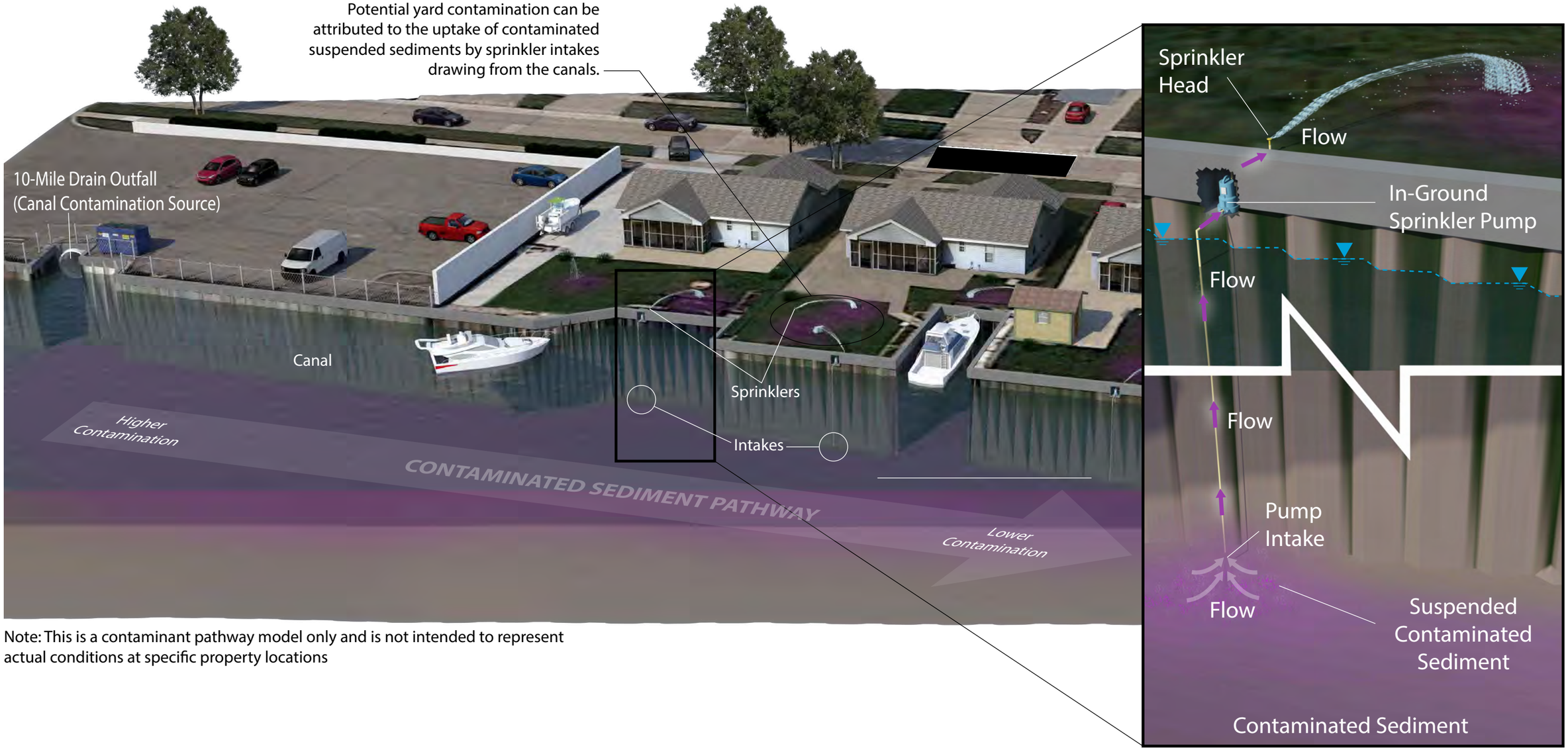


FIGURE 3
PCB Migration Model
Ten-Mile Drain Site
St. Clair Shores, Michigan



Note: This is a contaminant pathway model only and is not intended to represent actual conditions at specific property locations

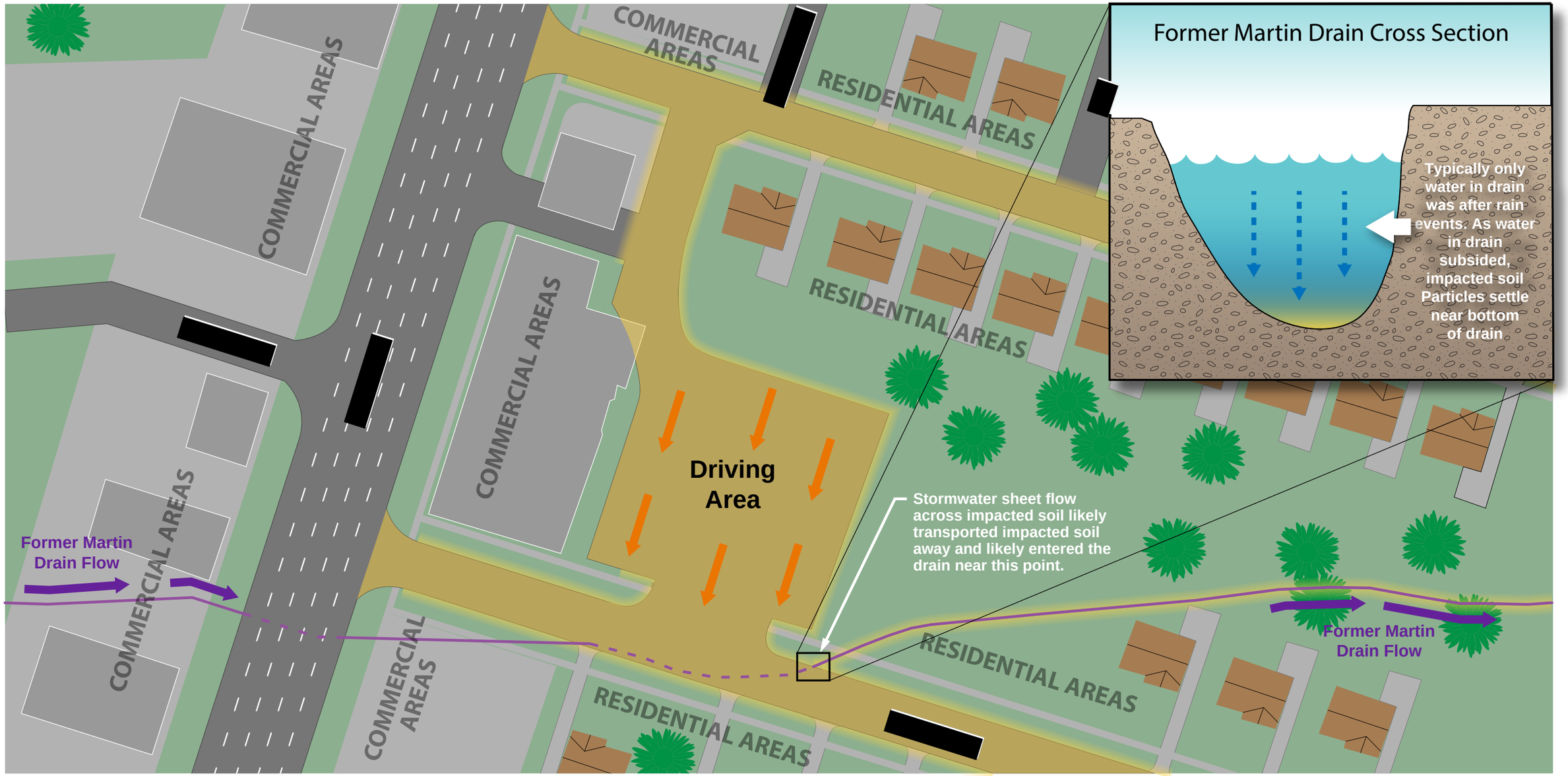
Note: Seiche effect assists in stiring bottom sediments to suspend them.

LEGEND

= Water Level

= Contaminated Suspended Sediments

FIGURE 4
Canal Property Contamination Model
Ten-Mile Drain Site
St. Clair Shores, Michigan



North

0 50 100

Approximate scale in feet

Notes: This is a contaminant pathway model only and is not intended to represent actual conditions at specific property locations.

Residential property depiction based on 1962 aerial photograph.

LEGEND

- Areas Potentially Impacted by PCBs
- Former Martin Drain
- Stormwater Sheet Flow

Stormwater Runoff to Old Martin Drain Contaminant Transport Model
Ten-Mile Drain Site
St. Clair Shores, Michigan

ch2m.

N

0 25 50

Approximate scale in feet

Legend

- Front Yard
- Parkway
- Back Yard
- Commercial Property
- >1.0 ppm

Notes:

1. ©Google Aerial Dated May 9, 2010
2. ND = Non-Detect

FIGURE 6
Bon Brae Street Residential Exposure Units
Focused Feasibility Study
Residential and Commercial Near Surface Soils
Ten-Mile Drain Superfund Site
Saint Clair Shores, Michigan

CH2MHILL

\\cypress\proj\Army Corp\St Clair Shores\mcds\Remedial Investigation\Figure Renumber\TenMileDrain_Figure4_RI.mxd 02/19/2014

N

0 40 80

Approximate scale in feet

Legend

- Front Yard
- Parkway
- Back Yard
- Commercial Property

Total PCBs

- <1.0 ppm TCRA[3]
- >1.0 ppm at depth TCRA[3]
- >1.0 ppm
- >10.0 ppm

Notes:

1. ©Google Aerial Dated May 9, 2010
2. Concentrations depicted, if not specified, are from the 0'-0.5' depth interval.
3. Total PCBs after Time-Critical Removal Action

Figure 7
Lakeland Street Exposure Units
Focused Feasibility Study
Ten-Mile Drain Superfund Site
Saint Clair Shores, Michigan

CH2MHILL

\\cypress\proj\Army Corp\St Clair Shores\MXDs\Remedial Investigation\Figure Renumber\TenMileDrain_Figure6_.mxd 02/19/2014

N

0 75 150

Approximate scale in feet

Legend

Back Yard

ND Non Detect for PCBs

>1.0 ppm

Notes:

1. Hightest Concentrations for yard area are reported.
2. Highest concentrations occurred in the 0'-0.5' interval unless otherwise noted.

FIGURE 8
Lange and Revere Street Canals
Focused Feasibility Study
Residential Exposure Units
Ten-Mile Drain Superfund Site
Saint Clair Shores, Michigan

CH2MHILL

\\cypress\proj\Army Corp\St Clair Shores\MXDs\Remedial Investigation\Figure Renumber\TenMileDrain_Figure5_RI.mxd 02/19/2014

Appendix A
Cost Estimates for Alternatives

Alternative 1 - No Action

January 30, 2017

Focused Feasibility Study Construction Cost Estimate

Ten-Mile Drain Near Surface Soils, St. Clair Shores, Michigan

Periodic Costs

Description	QTY	UNIT	UNIT COST	TOTAL COST
2019 5-yr Review	1	EA	$20,000	$20,000
2024 5-yr Review	1	EA	$20,000	$20,000
2029 5-yr Review	1	EA	$20,000	$20,000
2034 5-yr Review	1	EA	$20,000	$20,000
2039 5-yr Review	1	EA	$20,000	$20,000
2044 5-yr Review	1	EA	$20,000	$20,000

Present Value Analysis **DISCOUNT RATE** **1.4%**

YEAR	COST TYPE	COST	DISCOUNT RATE (1.1%)	PRESENT VALUE
0	Capital Cost	$0	1.00	$0
5	5-yr Review	$20,000	0.93	$18,657
10	5-yr Review	$20,000	0.87	$17,404
15	5-yr Review	$20,000	0.81	$16,235
20	5-yr Review	$20,000	0.76	$15,145
25	5-yr Review	$20,000	0.71	$14,128
30	5-yr Review	$20,000	0.66	$13,179
Total Present Value				**$95,000**

This is not an offer for construction and/or project execution. Please note, these order of magnitude cost estimates are assumed to represent the actual installed cost within the range of - 30 percent to + 50 percent of the costs indicated. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive variable factors. Due to these factors, project feasibility and funding needs must be carefully reviewed prior to making specific decisions to help ensure proper project evaluation and adequate funding.

Alternative 2 - Offsite Disposal of Excavated Material - Residential Properties (Includes 2 Parkway/Utility Corridors)

January 30, 2017

Focused Feasibility Study Construction Cost Estimate

Ten-Mile Drain Superfund Site, Saint Clair Shores, Michigan

Description - Excavation of soil exceeding PCB PRG (1ppm) on residential properties to a maximum depth of 2 1/2 feet below ground surface, transportation and offsite disposal of excavated material, and restoration (backfill, topsoil, and sod).

Description	Quantity	Unit	Unit Cost	Cost
Pre-Design Sampling				
Access Agreements	120	EA	$ 500	$ 60,000
Pre-Design Sampling	152	EA	$ 2,500	$ 380,000
Pre-Design Sampling Subtotal				**$440,000**

Property Remediation				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Site Specific Project Plans and Project Pre-Planning				
Site Specific Plans	1	LS	$ 25,000	$ 25,000
Community Involvement	1	LS	$ 25,000	$ 25,000
Site Preparation				
Mobilization (Includes Office Trailer, Temporary Utilities)	1	LS	$ 40,000	$ 40,000
Pre-Construction Survey	104	EA	$ 1,000	$ 104,000
Private Utility Locates	104	EA	$ 188	$ 19,500
Site Clearing/Tree Removal	104	EA	$ 1,500	$ 156,000
Property Excavation/Restoration				
Soil Excavation	7134	CY	$ 210	$ 1,498,140
Air Monitoring	104	EA	$ 500	$ 52,000
Lab Analysis for Disposal	104	EA	$ 500	$ 52,000
Transportation & Disposal Soil - Non-Hazardous Waste	9988	TN	$ 60	$ 599,280
General Fill	4780	CY	$ 170	$ 812,600
Topsoil Placement	2354	CY	$ 170	$ 400,180
Landscaping - Sod Installation	125528	SF	$ 2	$ 188,292
Tree/Shrub Replacement	104	EA	$ 550	$ 57,200
Sprinkler Re-Installation	104	EA	$ 2,000	$ 208,000
Post-Construction Property Survey	104	EA	$ 830	$ 86,320
Demobilization	1	LS	$ 37,400	$ 37,400
Implement Institutional Controls	1	LS	$ 11,500	$ 11,500
Bonds	1	EA	$ 80,000	$ 80,000
Property Remediation Subtotal				**$4,452,000**

Pre-Design Sampling and Property Remediation Subtotal	**$4,892,000**

Associated Planning and Construction				
Remedial Design	4%		$ 4,892,000	$ 195,680
Project Management	5%		$ 4,892,000	$ 244,600
Construction Oversight	8%		$ 4,892,000	$ 391,360
Construction Completion Report	1	LS	$ 30,000	$ 30,000
Contingencies	10%		$ 4,892,000	$ 489,200
Associated Planning and Construction Subtotal				**$1,351,000**

Total Capital Cost	**$6,243,000**

Periodic Costs				
Description	**QTY**	**UNIT**	**UNIT COST**	**TOTAL COST**
2019 5-yr Review	1	EA	$20,000	$20,000
2024 5-yr Review	1	EA	$20,000	$20,000
2029 5-yr Review	1	EA	$20,000	$20,000
2034 5-yr Review	1	EA	$20,000	$20,000
2039 5-yr Review	1	EA	$20,000	$20,000
2044 5-yr Review	1	EA	$20,000	$20,000

Present Value Analysis				
Present Value Analysis	**DISCOUNT RATE**	**1.4%**		
YEAR	**COST TYPE**	**COST**	**DISCOUNT RATE (1.1%)**	**PRESENT VALUE**
0	Capital Cost	$6,243,000	1.00	$6,243,000
5	5-yr Review	$20,000	0.93	$18,657
10	5-yr Review	$20,000	0.87	$17,404
15	5-yr Review	$20,000	0.81	$16,235
20	5-yr Review	$20,000	0.76	$15,145
25	5-yr Review	$20,000	0.71	$14,128
30	5-yr Review	$20,000	0.66	$13,179
Total Present Value				**$6,338,000**

This is not an offer for construction and/or project execution. Please note, these order of magnitude cost estimates are assumed to represent the actual installed cost within the range of - 30 percent to + 50 percent of the costs indicated. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive variable factors. Due to these factors, project feasibility and funding needs must be carefully reviewed prior to making specific decisions to help ensure proper project evaluation and adequate funding.

Assumptions

1. Property Assumptions

Assumes average exposure unit size of 1207 square feet and 68.6 cubic yards of soil to be excavated (based on average size and quantity of 30 exposure units already sampled). Excavation will not be performed under impervious surfaces.

2. Sampling Requirements

Includes pre-design sampling on an estimated 152 additional exposure units. Estimate assumes that confirmation sampling will not required after excavation. Includes two air monitoring samples per property.

3. Excavation and Disposal

All soil from residential exposure units will be disposed as non-hazardous. Assume up to 2 trees per lot will be removed (average 12-18 in diameter).

4. Site Restoration

Backfill production includes place/spread/compact, setup at each property, and relocate to the next. Backfill includes clean fill and 4 inches of topsoil. Placement of sod to expedite restoration and minimize O&M costs. Trees and shrubs will be replaced in lots only where they previously existed. Inventory taken before clearing and grubbing. Replacement of fences, repair to sidewalks, driveways and other landscape features. Also includes restoration to damaged underground utilities.

5. General Assumptions

Community outreach/communication via newspaper television, and prepare fact sheets. Two public meetings
Meeting costs include preparation, poster printing, and travel costs.

Required Subcontractor plans include, but not limited to, Work Plan/Schedule, Health & Safety Plan (HASP), and Activity Hazard Analyses (AHA), Transportation and Disposal Plan, Storm Water Pollution Prevention Plan (SWPPP), Environmental Control Plan (ECP), Spill Prevention, Control and Countermeasures (SPCC) Plan. Subcontractor home office support for project coordination and management. Assume subcontractor is located within 50 miles of the site; therefore, no per diem included. Field office trailers and related utilities. 3rd party utility locate prior to site excavation.

Clearing and grubbing - Includes removal of vegetation only: small trees and brush; removal or grinding of stumps and roots; and felling and removal of dead trees, partially dead trees and limbs, and trees and limbs that are a safety hazard to workers. Debris removal, movement of non-permanent property (swing sets, pools, fountains, etc. are the responsibility of the property owner).

Design, project management, construction oversight costs, and contingencies are estimated based on EPA 540-R-00-002 A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. Estimate contingency includes 10% scope + 10% Bid = 20%.

Alternative 2 - Offsite Disposal of Excavated Material - Commercial Property 1 ([redacted])

January 30, 2017

Feasibility Study Construction Cost Estimate

Ten-Mile Drain Superfund Site, Saint Clair Shores, Michigan

Description - Excavation of soil exceeding PCB PRG (10 ppm) on commercial property to a maximum depth of 2 1/2 feet below ground surface, transportation and offsite disposal of excavated material, and restoration (backfill, asphalt).

Property Remediation				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Site Preparation				
Site Specific Plans	1	LS	$ 5,000	$ 5,000
Mobilization (Includes Office Trailer, Temporary Utilities)	1	LS	$ 20,000	$ 20,000
Pre-Design Sampling	1	LS	$ 5,000	$ 5,000
Private Utility Locates	1	EA	$ 1,200	$ 1,200
Site Preparation	1	EA	$ 7,800	$ 7,800
Property Excavation/Restoration				
Soil Excavation	1778	CY	$ 18	$ 32,004
Post Excavation Survey	1	LS	$ 1,000	$ 1,000
Transportation & Disposal Soil - TSCA Soil	2667	TN	$ 180	$ 480,060
Air Monitoring	1	LS	$ 500	$ 500
General Fill	1185	CY	$ 29	$ 34,365
Aggregate Base - 6"	356	CY	$ 55	$ 19,580
18" RCP Storm Drain	200	LF	$ 55	$ 11,000
Replace Catch Basins	4	EA	$ 4,700	$ 18,800
Asphalt	19200	SF	$ 4	$ 76,800
Surveying	2	EA	$ 1,800	$ 3,600
Striping Allowance	1	LS	$ 1,500	$ 1,500
Property Remediation Subtotal				**$718,000**

Associated Planning and Construction				
Remedial Design	4%		$ 718,000	$ 28,720
Project Management	5%		$ 718,000	$ 35,900
Construction Oversight	8%		$ 718,000	$ 57,440
Construction Completion Report	1	LS	$ 10,000	$ 10,000
Contingencies	10%		$ 718,000	$ 71,800
Associated Planning and Construction Subtotal				**$204,000**

Total Capital Cost	**$922,000**

Periodic Costs				
Description	**QTY**	**UNIT**	**UNIT COST**	**TOTAL COST**
2019 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2024 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2029 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2034 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2039 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2044 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0

Present Value Analysis				
Present Value Analysis	**DISCOUNT RATE**	**1.4%**		
YEAR	**COST TYPE**	**COST**	**DISCOUNT RATE (1.1%)**	**PRESENT VALUE**
0	Capital Cost	$922,000	1.00	$922,000
5	5-yr Review	$0	0.93	$0
10	5-yr Review	$0	0.87	$0
15	5-yr Review	$0	0.81	$0
20	5-yr Review	$0	0.76	$0
25	5-yr Review	$0	0.71	$0
30	5-yr Review	$0	0.66	$0
Total Present Value				**$922,000**

Alternative 2 - Offsite Disposal of Excavated Material - Commercial Property 1 ([redacted])

January 30, 2017

Feasibility Study Construction Cost Estimate

Ten-Mile Drain Superfund Site, Saint Clair Shores, Michigan

Description - Excavation of soil exceeding PCB PRG (10 ppm) on commercial property to a maximum depth of 2 1/2 feet below ground surface, transportation and offsite disposal of excavated material, and restoration (backfill, asphalt).

This is not an offer for construction and/or project execution. Please note, these order of magnitude cost estimates are assumed to represent the actual installed cost within the range of - 30 percent to + 50 percent of the costs indicated. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive variable factors. Due to these factors, project feasibility and funding needs must be carefully reviewed prior to making specific decisions to help ensure proper project evaluation and adequate funding.

Assumptions

1. Property Assumptions

Assumes area to be excavate is 120 x 160 feet in size and will be excavated to a depth of 2.5 feet below ground surface.

2. Sampling Requirements

Includes pre-design sampling. Estimate assumes that confirmation sampling will not be required after excavation. Includes 2 air monitoring sample

3. Excavation and Disposal

All soil from commercial property will be disposed at a TSCA landfill

4. General Assumptions

Required Subcontractor plans include, but not limited to, Work Plan/Schedule, Health & Safety Plan (HASP), and Activity Hazard Analyses (AHA), Transportation and Disposal Plan, Environmental Control Plan (ECP), Subcontractor home office support for project coordination and management. Assume subcontractor is located within 50 miles of the site; therefore, no per diem included. Field office trailers and related utilities. 3rd party utility locate prior to site excavation.

Alternative 2 - Offsite Disposal of Excavated Material - Commercial Property 2 (Additional Property)

January 30, 2017

Feasibility Study Construction Cost Estimate

Ten-Mile Drain Superfund Site, Saint Clair Shores, Michigan

Description - Excavation of soil exceeding PCB PRG (10 ppm) on commercial property to a maximum depth of 2 1/2 feet below ground surface, transportation and offsite disposal of excavated material, and restoration (backfill, topsoil, and sod).

Property Remediation				
Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Site Preparation				
Site Specific Plans	1	LS	$ 5,000	$ 5,000
Mobilization (Includes Office Trailer, Temporary Utilities)	1	LS	$ 20,000	$ 20,000
Pre-Design Sampling	1	LS	$ 5,000	$ 5,000
Private Utility Locates	1	EA	$ 1,200	$ 1,200
Site Preparation	1	EA	$ 7,800	$ 7,800
Property Excavation/Restoration				
Soil Excavation	975	CY	$ 18	$ 17,550
Transportation & Disposal Soil - TSCA Soil	1463	TN	$ 180	$ 263,340
General Fill	650	CY	$ 29	$ 18,850
Aggregate Base - 6"	195	CY	$ 55	$ 10,725
18" RCP Storm Drain	50	LF	$ 55	$ 2,750
Replace Catch Basins	1	EA	$ 4,700	$ 4,700
Asphalt	10535	SF	$ 4	$ 42,140
Surveying	2	EA	$ 1,800	$ 3,600
Striping Allowance	1	LS	$ 1,500	$ 1,500
Property Remediation Subtotal				**$404,000**

Associated Planning and Construction				
Remedial Design	4%		$ 404,000	$ 16,160
Project Management	5%		$ 404,000	$ 20,200
Construction Oversight	8%		$ 404,000	$ 32,320
Construction Completion Report	1	LS	$ 10,000	$ 10,000
Contingencies	10%		$ 404,000	$ 40,400
Associated Planning and Construction Subtotal				**$119,000**

Total Capital Cost	**$523,000**

Periodic Costs				
Description	**QTY**	**UNIT**	**UNIT COST**	**TOTAL COST**
2019 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2024 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2029 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2034 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2039 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0
2044 5-yr Review - Included as Part of Residential Cost Estimate	0	EA	$20,000	$0

Present Value Analysis				
Present Value Analysis	**DISCOUNT RATE**	**1.4%**		
YEAR	**COST TYPE**	**COST**	**DISCOUNT RATE (1.1%)**	**PRESENT VALUE**
0	Capital Cost	$523,000	1.00	$523,000
5	5-yr Review	$0	0.93	$0
10	5-yr Review	$0	0.87	$0
15	5-yr Review	$0	0.81	$0
20	5-yr Review	$0	0.76	$0
25	5-yr Review	$0	0.71	$0
30	5-yr Review	$0	0.66	$0
Total Present Value				**$523,000**

Alternative 2 - Offsite Disposal of Excavated Material - Commercial Property 2 (Additional Property)

January 30, 2017

Feasibility Study Construction Cost Estimate

Ten-Mile Drain Superfund Site, Saint Clair Shores, Michigan

Description - Excavation of soil exceeding PCB PRG (10 ppm) on commercial property to a maximum depth of 2 1/2 feet below ground surface, transportation and offsite disposal of excavated material, and restoration (backfill, topsoil, and sod).

This is not an offer for construction and/or project execution. Please note, these order of magnitude cost estimates are assumed to represent the actual installed cost within the range of - 30 percent to + 50 percent of the costs indicated. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive variable factors. Due to these factors, project feasibility and funding needs must be carefully reviewed prior to making specific decisions to help ensure proper project evaluation and adequate funding.

Assumptions

1. Property Assumptions

Assumes area to be excavate is 120 x 160 feet in size and will be excavated to a depth of 2.5 feet below ground surface.

2. Sampling Requirements

Includes pre-design sampling. Estimate assumes that confirmation sampling will not be required after excavation. Includes 2 air monitoring samples.

3. Excavation and Disposal

All soil from commercial property will be disposed at a TSCA landfill.

4. General Assumptions

Required Subcontractor plans include, but not limited to, Work Plan/Schedule, Health & Safety Plan (HASP), and Activity Hazard Analyses (AHA), Transportation and Disposal Plan, Environmental Control Plan (ECP), Subcontractor home office support for project coordination and management. Assume subcontractor is located within 50 miles of the site; therefore, no per diem included. Field office trailers and related utilities. 3rd party utility locate prior to site excavation.